

DOES STAKEHOLDER ‘AUTONOMOUS AGENT’ GAMING IN THE GENERAL
ECONOMY AFFECT LAST PLANNER SYSTEM PERFORMANCE?

A Thesis

by

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ABSTRACT

Lean Construction (LC) has proven to be beneficial for the productivity of individual projects; however, its impact on the industry has not been significant. One reason affecting the performance of LC is the self-interested behavior of stakeholders, formally named Autonomous Agents (AA) interacting in Game Theory frameworks. Examples of AAs are general contractors, architects, and consultants, but especially subcontractors, the main research focus. This thesis defines whether the behavior of AAs affects the performance of LC tools such as the Last Planner System (LPS). Using a qualitative approach, the researcher collected data through personal interviews of 74 participants, spread over eight projects throughout Texas, all of which were built by four construction companies. A quantitative approach was used to analyze the interviews. Findings indicate, with a 99% confidence level, that the majority of the study population supports these statements: (1) subcontractors behave as AAs, (2) the LPS does not prevent the AA behavior of subcontractors but it supports managing the associated issues, and (3) the AA behavior of subcontractors affects the LPS performance. Future research is proposed regarding possible solutions for this problem.

DEDICATION

To Nancy, who always supported me. To my mother Olga, who taught me how to survive in life. To my aunt Norma, my best advisor. To my uncles Agustin and Martha, for showing me the real meaning of love. To Nana, who is always looking after me.

To God...

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NOMENCLATURE

AA	Autonomous Agent
AGC	Associated General Contractors of America
BIM	Building Information Modeling
BLS	Bureau of Labor Statistics
CI	Confidence Interval
CPM	Critical Path Method
IGLC	International Group for Lean Construction
IRB	Texas A&M Institutional Review Board
LC	Lean Construction
LCC	Life Cycle Cost
LCI	Lean Construction Institute
LPS	Last Planner® System
PERT	Project Evaluation and Review Technique
PPC	Plan Percent Complete
SLR	Structured Literature Review
WWP	Weekly Work Plan

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1. INTRODUCTION

Labor productivity in the U.S. construction industry has declined over the last 50 years. This situation is an industry specific problem, because labor productivity of other non-farm industries in the U.S. reflects a positive trend in the same period (Teicholz 2013). Researchers in construction have identified productivity as an important research topic throughout the years (Hendrickson 2005; Teicholz 2013; Shen et al. 2010; Eastman and Sacks 2008; Bertelsen and Sacks 2007; Rojas and Aramvareekul 2003). Construction productivity is now a worldwide research topic (Shen et al. 2010).

To address the low productivity issue, researchers, in collaboration with practitioners, have proposed several project management tools and methodologies, such as the Critical Path Method (CPM), Total Quality Control, several Project Delivery Methods (Design-Bid-Build, Design-Build, Construction Management at Risk, Bridging, etc.), Resource Leveling, Line-of-Balance, and many other frameworks (Alarcon 1997; Forbes and Ahmed 2011; Koskela et al. 2014). Those management tools have reduced some waste and increased productivity of individual projects, but those benefits have not accrued to the industry (Alarcon 1997; Forbes and Ahmed 2011; Teicholz 2013). The problems with the use of traditional project management methodologies are: (1) approximately 50% of weekly scheduled activities are successfully accomplished (Ballard and Howell 1994; Alarcon 1997; Forbes and Ahmed 2011; Ballard 1999; Ballard and Howell 1999); (2) poor communication between participants inhibits productivity (Forbes and Ahmed 2011); (3) safety issues cause productivity decrease (Forbes and Ahmed

2011); and (4) a comfortable status quo about the benefits exists, since many methodologies were never systematically tested for empirical validity (Koskela et al. 2014).

Alarcon (1997) indicates that Lean Construction (LC) is a relatively new project management methodology, adapted from the manufacturing industry, with the intent to improve construction productivity. LC addresses the need of an adapted Theory of Production for the construction industry as proposed by Koskela (2000). LC has potentially been categorized as the project management tool that may change the negative trend for construction productivity (Forbes and Ahmed 2011; Alarcon 1997; Ballard and Howell 1994; Ballard 2008). LC focuses on improving construction productivity by two means: identification and reduction of waste, and improvement of management systems affecting work flow (Alarcon 1997).

Ballard (2000), in response to the need for work flow improvement in the industry, proposed one of the most widely used tools in the LC movement, The Last Planner System (LPS). The LPS focus is to holistically enhance the overall performance of a construction project through workflow variability and smoothness, so all resources can be maximized (Forbes and Ahmed 2011). This is a “will-do” tool that allows the establishment of a tracking control for promises in the day-to-day performance of all stakeholders (e.g., contractors, subcontractors, architects, engineers) directly involved in the project (Ballard 2000). One main reason for implementing the LPS in the construction industry is that the relationship of effectiveness between waste/production is not as effective as in other

industries using and receiving the benefits of the Lean principles, such as the manufacturing industry (Alarcon 1997).

However, LC has several challenges that have affected its performance (Formoso and Moura 2009; Green 2011; Winch 2010). Sack and Harel (2006a) and Fernández-Solís et al. (2015) state that one main challenge of the LPS is that it does not contemplate the real strategic situations of all stakeholders involved in the project. This means that correct resources are allocated in the project, as long as they do not have another more important compromise somewhere else, for example, a multiple project situation with co-shared responsibility (Sacks & Harel, 2006a; Fernández-Solís et al. 2015).

Per Sacks and Harel (2006b), much of the research done on LC and the LPS considers a conceptual situation within the boundaries of a single project or a single value stream, leaving out the effects of external projects or external conditions affecting the researched projects. Sacks and Harel (2006b) suggest that research about construction productivity should be modeled with considerations of multiple projects in different environments affecting the performance of the different parties involved. Dismissing the effects of external factors on projects could be a reason that LC's performance has been inconsistent, reducing its impact in improving the industry's productivity.

Fernández-Solís (2008) indicates that the general economy may be a starting point for the previous situation, as it dictates the general rules by which the global economy flows and in which direction. That direction is suggested by the game theories in which 'Autonomous Agents' (AAs) play a game, making decisions according to their interior strategic plans with the final goal of pursuing their own benefit (Fernández-Solís, 2008;

Myers, 2013). Gaming is relevant to the construction industry because every project's overall performance is affected directly or indirectly by external factors, thus it is necessary to establish an effective control tool that considers this situation (Fernández-Solis, 2008).

This thesis answers the question: does the stakeholder 'autonomous agent' gaming in the general economy affect the performance of the LPS? The methodology used is formed by: (1) a qualitative approach through a structured literature review (SLR) of past research related to the research objective, (2) a mixed approach (qualitative and quantitative) to analyze interviews of construction practitioners regarding the research objective. The data was obtained through analyzing the interviews. The expected findings are to obtain significant results supporting the hypothesis that stakeholder 'autonomous agents' actually affect the performance of the LPS. The assumptions and limitations on this study are: (1) the perceptions of the interviewees about the research objective are a significant indicator of the trend in the entire population; (2) the sample of 74 interviews is sufficient to define the trend in the entire population; (3) the study is limited to commercial projects; and (4) solutions to the research objective will only be proposed for future research.

2. STRUCTURED LITERATURE REVIEW*

2.1 ECONOMIC PRINCIPLES AND THE CONSTRUCTION INDUSTRY

The general economy affects the performance of the construction industry (Myers 2013), such that positive general economic indicators push investment in the construction industry (see Figure 1). Cleavers (2014) indicates that economics is concerned with the allocation of a fixed set of resources, which for the construction industry means the allocation of what, when, how and for whom investments should be made. In this process of investment allocation, decisions ultimately create an opportunity cost, a concept used in economics to call for what is lost given a specific choice (Newman et al. 2012). Fernández-Solis (2008) and Pryke (2004) define the construction industry as a complex system, due to the inherent non-linearity of events affecting a construction project.

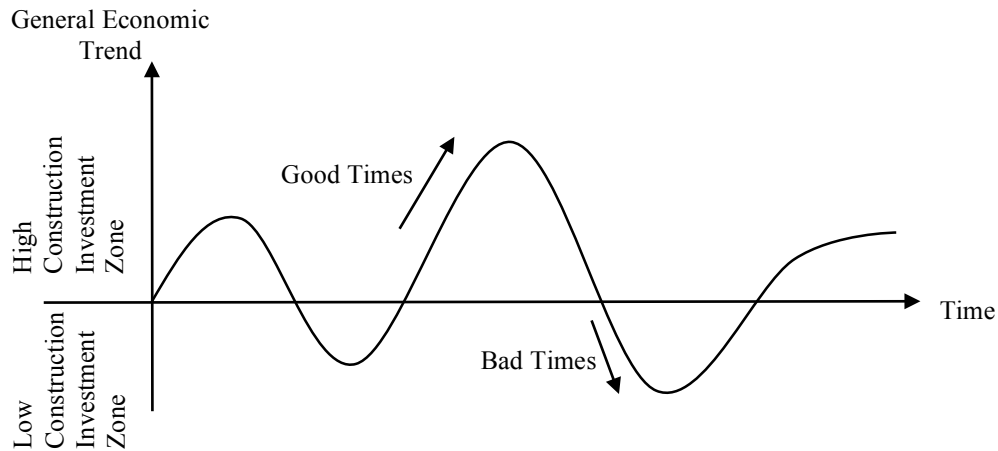


Figure 1. General economy effects in the construction industry

* Part of the data reported in this section is reprinted with permission from “Labor-productivity declines in the construction industry: causes and remedies (another look)” by Teicholz, P. (2013) -- AECbytes Archived article.”
<http://www.aecbytes.com/viewpoint/2013/issue_67.html> (Dec. 12, 2015)

Due to the complexity of this industry, the relatedness between stakeholders is increased, thus the competition between them. As indicated by Basilgan and Christiansen (2014), game theory, a branch of economics, studies the factors of competition between stakeholders. For this competition analysis, game theories use the concept of ‘autonomous agents’ (AAs) to study the interactions between self-interested agents (Parsons and Wooldridge 2012). Fernández-Solís et al. (2015) define an AA in construction as a stakeholder making tactical decisions for its own interest with asymmetrical information in the project. Fernández-Solís (2008) indicates that AA behavior may be present at any company level, such as the strategic, logistic, and tactical levels. This behavior may be present in firms such as general contractors, subcontractors, consultants, etc., and at any position level such as foreman, superintendent, project manager, etc.

Myers (2013) indicates that game theory explains how the outcome plan for any firm in a project will be ultimately affected by the planned outcomes for the rest of the firms in the project, due to the AA behavior. Subcontractors are widely seen as the typical example of AAs due to their self-interested behavior (Wang 2010; Sacks and Harel 2006b; Asgari and Afshar 2008; Miller et al. 2012). Sacks and Harel (2006b) affirm that game theories can be applied to analyze the behavior of subcontractors in the meta-project environment as addressed by Fernández-Solís et al. (2015). Appendix A contains a deeper analysis of the relationship between the general economy and the construction industry, with emphasis on the definition of the AA in the industry.

2.2 CONSTRUCTION PRODUCTIVITY

The construction industry is one of the largest elements of the United States economy. During 2007, the Bureau of Labor Statistics (BLS), U.S. Department of Labor, reports that the construction industry represented a value of \$1,260.128 billion, which is approximately 8% of the total gross domestic product (Forbes and Ahmed 2011). The same report indicates that the construction industry employed 7.6 million people. The construction industry has not been significantly affected by the offshore mode used by many companies in the manufacturing and services industries to relocate their operations outside the United States (Forbes and Ahmed 2011). In a way, the construction industry has been a uniquely domestic industry, as any competition is typically located inside the country's borders, while the manufacturing and services industries must react to global competition (Forbes and Ahmed 2011). Even when foreign construction companies enter the U.S. market, the great majority of workforce is local, as are the subcontractors.

Even after new initiatives, technologies and techniques, such as CPM, LC, the LPS, Building Information Modeling (BIM), among others, research indicates that the construction industry has seen no significant improvement of labor productivity over the past five decades (Teicholz 2013). It is surprising that minor improvements generated throughout the years in construction productivity is due to the transfer of research and development from the manufacturing industry (Ahmed and Forbes 2011). Figure 2 and the corresponding analysis suggest that labor productivity for the overall construction industry presents a growth diminution tendency over the last five decades, without considering the small peaks.

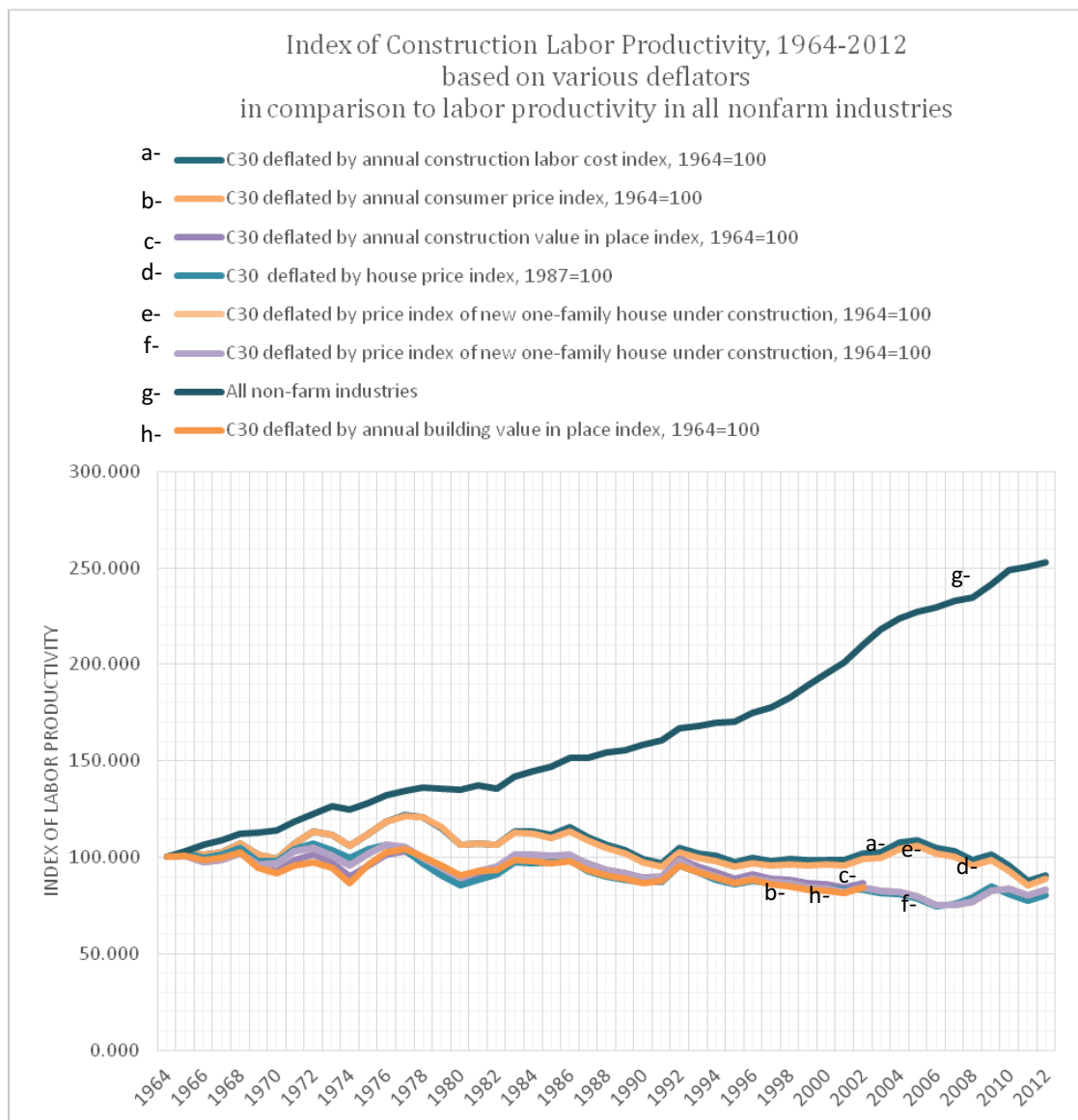


Figure. 2. Labor productivity in the construction industry. Reprinted from Teicholz (2013), with permission

Figure 2 also notes variation within different deflators such as price index, labor cost index, house price index and others. Nonetheless, the general trend is a gradual constant decline. The adjusted line trend indicates a reduction of 0.32% per year, when in

the nonfarm industries there is a 3.06% positive trend per year (Teicholz 2013). Thus, the net impact over five decades is highly significant. Based on the construction data collected by the U.S. Bureau of Labor Statistics and The Department of Commerce (Census Bureau), as well as inclusive data analysis by the Bureau of Economic Analysis, Teicholz (2013) argues that there is a significant number of structural problems in the construction industry; those problems affect the improvement of labor productivity, and even worse, they show no improvement over time.

Researchers and practitioners debate the reasons for low productivity in the construction industry. Forbes and Ahmed (2011) argue that the main reason is a lack of effort in research and development. Bertelsen and Sacks (2007) attribute the problem to the natural tendency of this industry to behave as a dynamic complex system, which requires integrated and collaborative effort frameworks for its stabilization, an objective that has not been effectively addressed as of this writing. This problem is significant for the construction industry, because the issue is global (Bertelsen and Sacks 2007).

Even when it seems evident that construction productivity is declining over time, other opinions disagree. Rojas and Aramvareekul (2003) argue that the BLS data (Figure 2) presents so many problems that it is not a reliable source with which to penalize the whole industry and categorize it as an unproductive industry. Indeed, further review of this study by Hendrickson (2005) suggests that during the previous two decades before the study, there is evidence indicating a positive trend in labor productivity on the construction industry. Eastman and Sacks (2008) argue that results from the BLS about labor productivity in the construction industry lack accuracy due to little consideration of

off-site activities directly related to construction, such as precast panel fabrication, manufacturing of steel structures, BIM and many others, that positively affect construction productivity even when its outcome is not overseen at the job site. These counter arguments to the generally accepted position of low labor productivity in the industry is a clear indicator of the need for hard data research and development efforts, which would allow for further clarification in important topics, like construction productivity.

The construction industry, aware of the poor productivity image and high waste, implemented a number of techniques such as CPM, Total Quality Control, Bridging, Project Evaluation and Review Technique (PERT), several Project Delivery Methods, Resource Leveling, Line-of-Balance and many others (Alarcon 1997; Forbes and Ahmed 2011; Koskela et al. 2014). The sum of these efforts have not significantly impacted the trend, as indicated by Teicholz (2013). The main problem with the use of traditional project management methodologies is captured by the reports indicating an industry wide successful accomplishment rate of 50% of weekly scheduled activities (Ballard and Howell 1994; Alarcon 1997; Forbes and Ahmed 2011; Ballard 1999; Ballard and Howell 1999).

One perfect example of the tools trying to improve construction productivity is the Critical Path Method (CPM). The CPM has been recognized as one of the most relevant construction management tools, whose intent is to detect the “longest irreducible sequence of events” in a project, with the final goal of improving the project’s construction productivity (Koskela et al. 2014). Figure 3 explains how CPM searches for the most critical path of activities that cannot be reduced time-wise. Koskela et al. (2014) report

several deficiencies in the use of CPM: the plan outcome of this tool is rarely followed on the field as variation is hardly considered, workflow is not supported by CPM, the process pushes stakeholders to act in the interest of only their own benefits and not for the whole project, and some others. Koskela et al. (2014) argue that the lack of enough empirical research about this methodology created a status quo about its benefits; consequently, owners adopted it and pushed for their work, as for them it was a contract management enforcement tool rather than a production management tool. That is a compelling reason why this tool has prevailed in the industry for more than five decades.

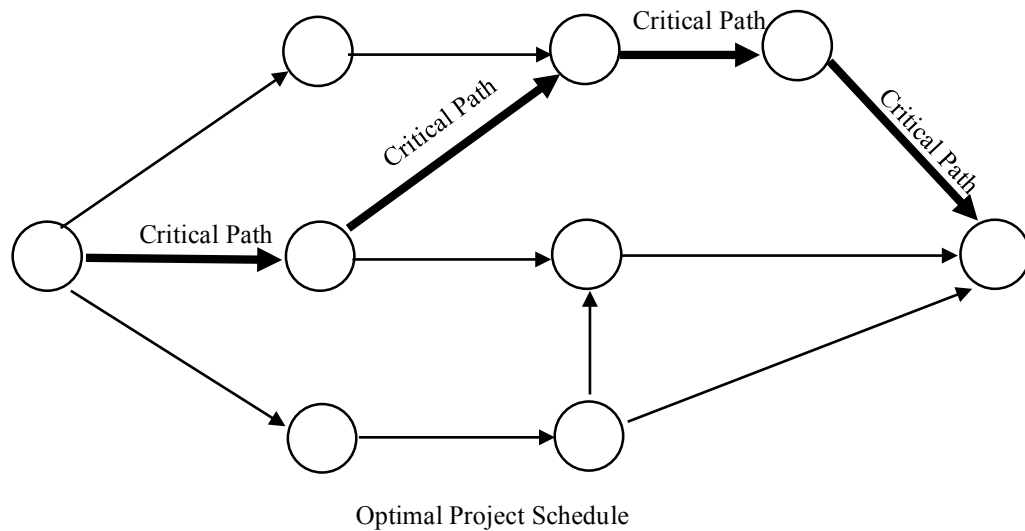


Figure 3. Example of a Critical Path Method diagram. Adapted from Tran and Hoang (2014)

2.2.1 Lean Construction

Lean Construction (LC) is a relatively recent project management movement, derived and adapted from the manufacturing industry (Alarcon 1997; Forbes and Ahmed 2011). LC is oriented to increase construction productivity by concentrating the

management team on identifying and eliminating all kinds of waste and improving production flow within a continuous improvement model (Alarcon 1997; Forbes and Ahmed 2011). Continuous improvement identifies non-value elements in the complete process, formerly named waste, by focusing on flow control and elimination of obstacles to improve performance reliability and reduce variability in production.

The origins of LC started in the manufacturing industry (Forbes and Ahmed 2011). The Toyota Corporation adapted their operations from the continuous flow concept created by Henry Ford before World War II (Liker 2004; Forbes and Ahmed 2011). After World War II, Toyota adapted their complete operation to the concept of Just-In-Time (JIT) to compete with major manufacturers using mass production techniques (Liker 2004). The JIT approach bases production in the fact that orders are worked only when they are needed, in the quantity they are needed and with the characteristics the customer needs (Liker 2004; Forbes and Ahmed 2011). This is a “pull” system in which work starts only when it is required by a downstream element, avoiding waste such as inventory, quality issues, rework, workflow constraints (Liker 2004). Such system is the opposite to a “push” system, which works on orders in a pre-planned schedule (Liker 2004). The JIT approach was one of the two pillars of the Toyota Production System (TPS) that is the basis of all the Lean Manufacturing philosophy (Liker 2004). The second pillar of the TPS is named *Jidoka*, which focuses on creating built-in quality in the production system (Liker 2004). The TPS has evolved and improved the company’s performance over more than six decades, and is one reason why Toyota is currently one of the top leaders of the car manufacturing industry (Liker 2004). The impact has been such that in other industries,

inside or outside of manufacturing, TPS principles have been adopted by companies throughout the world (Liker 2004). Figure 4 explains the TPS components.

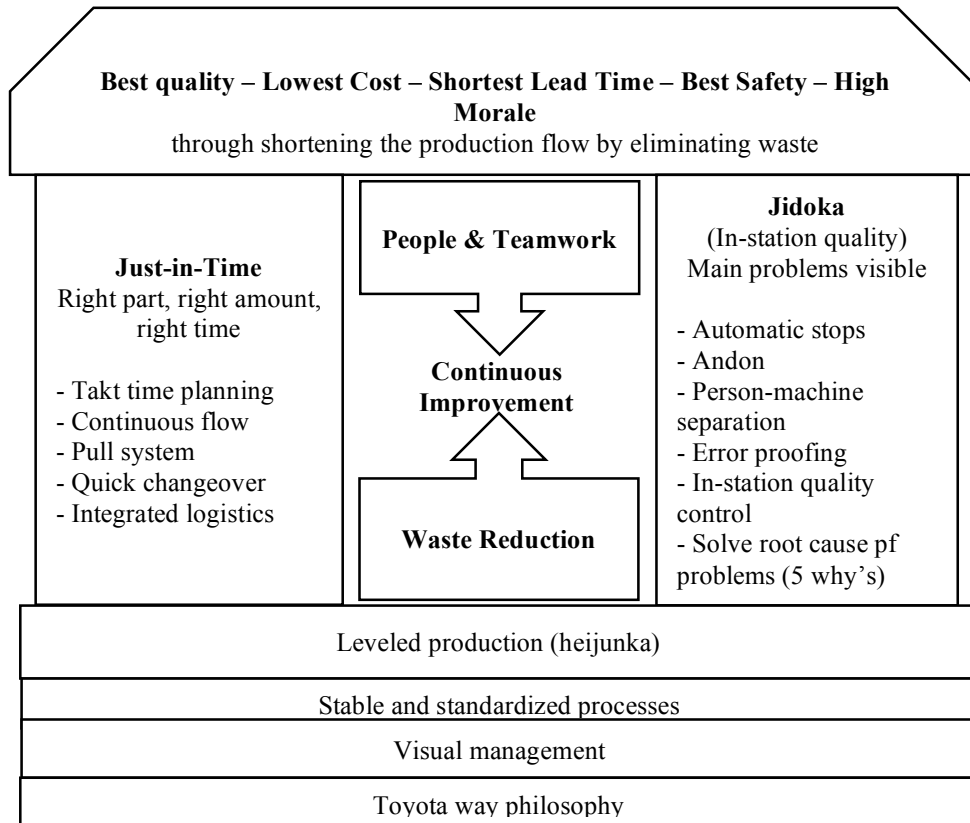


Figure 4. Toyota Production System. Adapted from Liker (2004)

The creation of LC started with Koskela's (1992) proposal about a new production philosophy based on the principles of the TPS. Koskela (1992) argued that the construction industry should be viewed and modeled as a flow of processes rather than the traditional methods of considering it a series of conversion activities. Koskela (1992) asserted that with the use of this philosophy, a significant improvement in productivity was expected, similar to that achieved in the manufacturing industry. The Lean Construction movement

started and academia continued working on research about this topic during the 1990's. Some influential researchers, such as Glen Ballard and Greg Howell, joined efforts with Lauri Koskela to work on this topic. The term Lean Construction (LC) was first adopted in the first meeting of the International Group for Lean Construction (IGLC) in August 1993 (Forbes and Ahmed 2011). Subsequently, in the United States in 1997, Ballard and Howell co-founded the Lean Construction Institute (LCI), one of the major organizations encouraging LC research and practice in the industry (Forbes and Ahmed 2011).

Although LC significantly differs in the way it handles projects, it does not replace scheduling tools such as CPM, as the purpose of LC is to enhance the productivity of short-term activities by working within traditional tools (Forbes and Ahmed 2011). The lean method focuses on optimizing activities at the project level, while traditional methodologies focus on improving individual activities (Forbes and Ahmed 2011).

Womack and Jones (2010) identified the five Lean principles that describe the fundamentals of LC:

1. Value: identify the value for customers, rather than persuading customers to find value in what organizations wish to provide.
2. Value Stream: creating a map of value for services or products, identifies waste for its removal.
3. Flow: Value should be created by reducing or eliminating impediments in the process, to create flow.
4. Pull: Every participant in the process should only consider starting to work when the customer in the downstream demands the order.

5. Perfection: A constant improvement process should be in place to strive for perfection, even when it is impossible to achieve it.

The impact of LC in the construction industry is a topic of focused research at the moment, but preliminary rough findings indicate that there are some benefits when applied to construction projects. Alarcon et al. (2005) suggest that there are significant benefits for projects using LC methodologies, such as improved plan reliability, a more stable and improved Plan Percent Complete (PPC) indicator (the basic metric in LC for plan reliability), and an overall improved project performance. A recent study by Mace (2016) estimates that, on average, construction projects with a High Lean Intensity are three times more likely to finish ahead of schedule and two times more likely to finish under budget.

Technology should be considered a priority to enhance the benefits of LC in construction projects. BIM supports the implementation of LC tools in projects, as it provides visualization to detect clashes before they arise, basically preventing waste (Forbes and Ahmed 2011). It can support LC through the different phases of a construction project, from the design phase, to the construction phase and even in the facility management phase (Forbes and Ahmed 2011). Sacks et al. (2010) state that BIM should be implemented along with LC techniques, to support the Theory of Production required for the construction industry as proposed by Koskela (2000).

2.2.1.1 Counter arguments of Lean Construction

Even though benefits of LC seem to be significant in construction projects, there are opinions counter to that. Green (2001) indicates that the LC movement lacks clarity in

the empirically identified benefits of its tools. Green (2001) perceives an over estimated assumption of the LC benefits, creating a generalization of its outcomes. Green (2010) says that LC was mainly supported by sources such as *Rethinking Construction* by Egan (1998), which are based in assumptions rather than structured research. It is important for stakeholders in the field to be rigorous about the way LC should be implemented in projects (Green 2001). Winch (2010) argues that it is difficult for LC to adapt the lean manufacturing principles, because the construction industry works on a one-of-a-kind project basis, thus mass production principles may only be applied to certain new build construction sectors, not to the industry as a whole, including remodeling, repair, and maintenance. Figure 5 explains the systems abstraction differences and similarities between the manufacturing and the construction industry. Products in the manufacturing industry are a high volume and consumption type, while in construction products are low in volume and consumption but with higher financial implications, that is the main reason of the unparalleled version of both industries.

Mossman (2009) implies that the main challenge of LC is that it should only be considered as a tool whose effects will be seen only on a long-term basis, after a consistent and conscious strategy is implemented and supported by a senior level champion, implementing it through the different levels of an organization. Attempting to do the opposite is discouraging for practitioners, which is one of the reasons for its low acceptance.

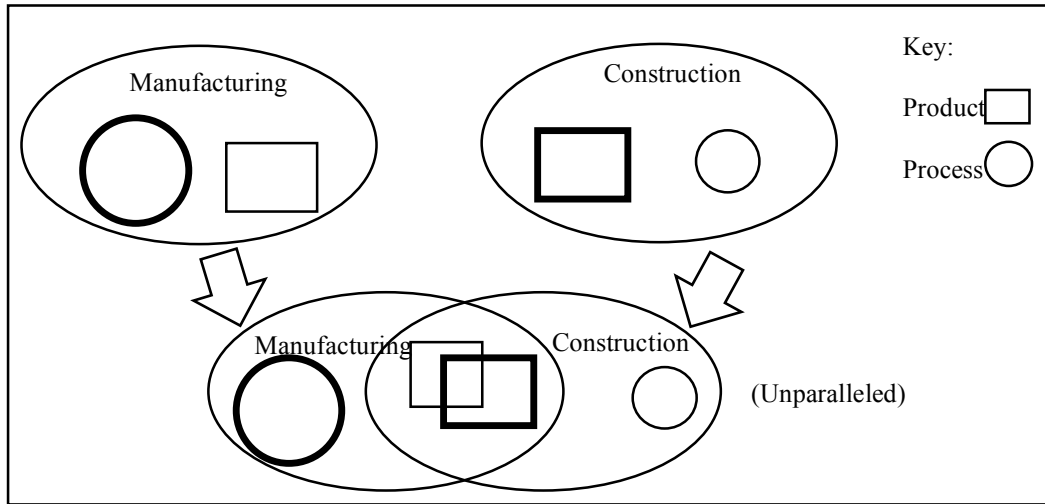


Figure 5. Systems abstraction. Adapted from Fernández-Solís (2008)

2.2.2 The Last Planner System

One of the main tools in LC is the Last Planner System (LPS), conceived and developed by Ballard (1994), which introduced major changes to the traditional methodologies in managing and planning construction projects. The LPS is an open platform used in the construction industry aimed to reduce the inefficiency of hierarchical layers in construction management, and to empower field stakeholders actually doing the work (Forbes and Ahmed 2011; Ballard 2000). The expected outcome of the LPS is optimizing the available resource allocation in the scheduling, planning and execution processes (Forbes and Ahmed 2011; Ballard 2000). Since the impact of the LPS in individual projects has been recognized as significant, in just two decades, numerous improvements have been applied to the LPS, such as new tools, research, techniques and measures (Fernández-Solís et al. 2013; Ballard 2008). The LPS is now a global phenomenon (Daniel et al. 2015).

Sacks and Harel (2006a), Forbes and Ahmed (2011) and Ballard (2000) sustain that the methodologies of the LPS are focused on three main streams. The first one is “look ahead planning,” which concentrates filter analysis on the weekly work schedule to ensure all preceding activities are terminated accordingly. No less important is that “look ahead planning” also seeks commitment by labor force leaders or work teams by focusing on the establishment of certainty and reliability in the schedules. The second main stream is the “make-ready” process, which aims to ensure that materials, information and equipment are ready, to allow construction managers to commit and make work ready. If the first two main streams are reasonably common in the traditional methods applied by experienced projects managers, then the last main stream could be labeled as the most significant one. The third is the daily work plan, traditionally named as “daily huddles.” This stream assumes a paradigm change from should to can (or push to pull), requiring a high sense of training in Lean practices and LC by all stakeholders. Figure 6 explains the different action levels of the LPS.

The LPS concentrates efforts on the fundamental interaction between plan reliability and reliable relocation of resources. It notes a central commonly unforeseen statement that individuals who are actually performing the work are the most secure predictors of labor productivity because they are the ones who literally allocate the labor resources (Baldwin and Bordoli 2014). Deductive inference can be made that having more reliability in the project work plan means that subcontractors will be inclined to correctly allocate resources, so subsequently they will reduce their lost time, creating a better work flow on the project progress. Sacks and Harel (2006a) argue that, even though it seems to

be the ideal solution to a traditional problem in the construction industry, a deep understanding of the relationship between plan reliability and reliable relocation of resources is needed so it can effectively benefit the industry. In other words, LPS application does not automatically guarantee waste elimination and increase productivity. This points to the problem that every project is invariably completed by different subcontractor crews and therefore, an everlasting training situation develops. Sacks and Harel (2006a) note that a game theory model applied to the significance of the LPS in construction projects indicates a clear correlation between the Percent Plan Complete (PPC) and the decisions of subcontractors in resource allocation.

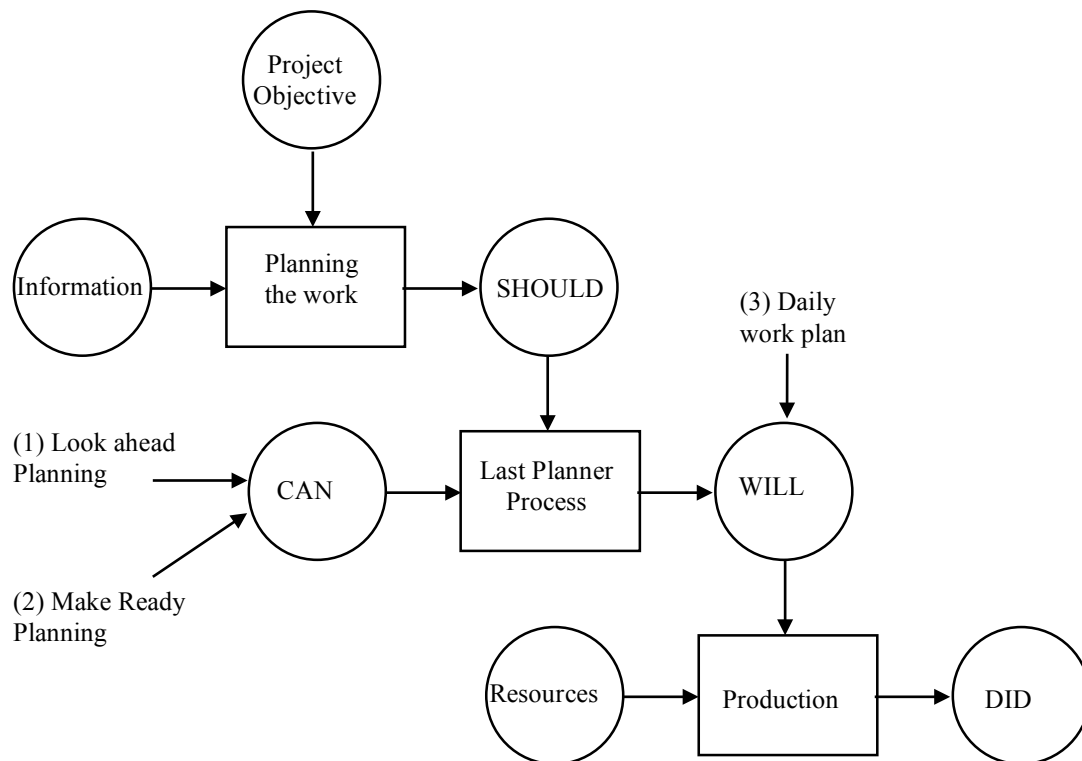


Figure 6. The Last Planner System. Adapted from Ballard (2000)

Howell and Macomber (2002) suggest nine main steps to successfully implement the LPS in construction projects:

1. Project promises should be clarified with the customer.
2. Building the appropriate team for the project.
3. Create the Milestones Plan and the Pull Schedule.
4. Use the Look-Ahead plan to Make the Work Ready.
5. Create a Weekly Work Plan (WWP).
6. Conduct the first WWP meeting.
7. Track on the wall the PPC.
8. Track on the wall the reasons for variance on the plan.
9. Establish practices for improvement, consider using a plus-delta review.

Fernández-Solís et al. (2013) reported the following main benefits attributed to the implementation of the LPS in construction projects: smooth work flow, predictable work plans, cost reduction, time reduction in project delivery, construction productivity improvement and enhanced collaboration between different work teams. The results reported by Fernández-Solís et al. (2013) concur with the results about the benefits of LC in the studies of Formoso and Moura (2009), Viana et al. (2010), Alarcon et al. (2005), Baldwin and Bordoli (2014) and Porwal (2010). Fuenzalida et. al (2016) reported benefits of LC regarding the environmental impact of projects--it reduces their carbon footprint.

However, the main challenges of implementing the LPS in projects are reported as well by Fernández-Solís et al. (2013), including: absence of leadership, organizational inertia, blocking change, absence of training, contractual issues, reduced experience and

knowledge, among others. The results reported by Fernández-Solís et al. (2013) concur with the results about the challenges of LC in the studies of Kalsaas et al. (2009), Johansen and Porter (2003), Viana et al. (2010), Alarcon et al. (2005), Baldwin and Bordoli (2014), Porwal (2010), and Hamzeh and Bergstrom (2010).

Even though there are challenges to overcome, there is a clear incremental implementation of the LPS in industry. The incremental growth indicates that challenges can be considered to be conquerable or even non-critical. Fernández-Solís et al. (2013) argue that addressing the challenges will increase the confidence level of construction stakeholders on its usage, improving the value it represents for construction productivity. Ballard and Howell (2003) indicate that the lack of research is one of the greatest challenges of the LPS, specifically research that compares projects with and without the use of the LPS. The available research suggests benefits of the LPS in individual projects, but research analyzing the benefits for the industry as a whole is rare.

2.3 AUTONOMOUS AGENTS AND CONSTRUCTION PRODUCTIVITY

As suggested in section 2.2, there is a preponderance of research focused on LC and the LPS; however, as Ballard and Howell (2013) stated, the available research is not enough to fulfill the needs of innovation in the construction industry. Sacks (2014) and Fernández-Solís et al. (2015) identified that one of the gaps in the knowledge about LC and the LPS is the consideration of a multi-project environment within organizations interacting on different projects. Sacks (2014) suggests that much of the LC research and

its implementation has been performed within the limits of an individual project or an individual value stream.

Over time, subcontracting in construction has become an important way to structure the operation of construction projects, because the requirements of projects require a higher specialization of trades, increasing off-site pre-fabrication, and agility in adjusting capacity to fluctuating demand of work with general contractors (Sacks 2014). Typically, subcontractors perform 80% to 90% of work on U.S. construction projects (Hinze and Tracey 1994). The outcome of this subcontracting situation is that subcontractors must work on different projects at the same time, a meta-project, balancing resources between them. Figure 7 explains how subcontractors interact between different projects.

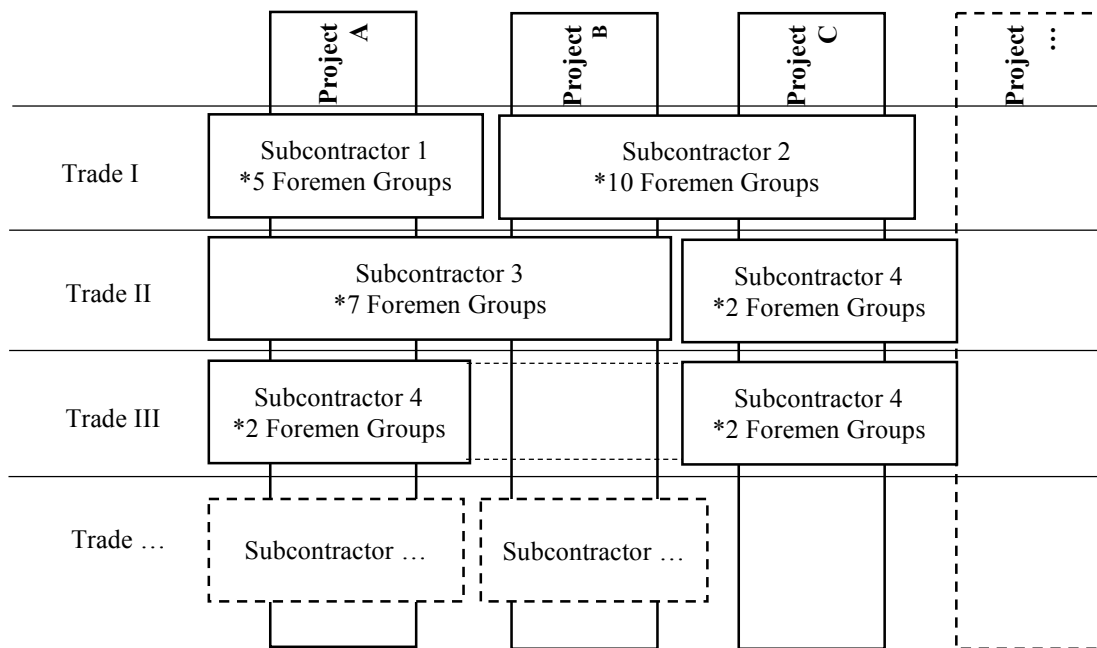


Figure 7. Sub-contractor work environment of meta-project. Adapted from Sacks (2004)

The problem with the meta-project scenario for subcontractors is that they act strategically when making decisions in different projects. Sacks and Harel (2006b) found how allocation of resources works in projects by applying a game theory model to a multi-project scenario of subcontractors and project managers. Through the use of Social Network analysis, Figure 8 explains the network of meta-projects created by AAs in construction projects. A subcontractor work force on a project is directly responsive to its subcontract company that has many projects going on at the same time. Current scheduling efforts assume that “our” project is the only one in a vast void universe. However, reality is much different and a subcontractor has a solar system of projects revolving around itself as it is the center of means and methods. A catastrophe in any project at any one time will have an effect on “our” project. Each subcontractor is an AA and all crews assigned to each project are owned by and respond to the subcontractor who in turn interfaces with the project manager and superintendent. When there is a “fire” in one project, the subcontractor acting in its own best interest will re-align resources to bring the project(s) with “fire” under control.

Sacks and Harel (2006b) found that if plan reliability on a project is low, then the resource allocation of subcontractors enters into a defensive status, where fines and rewards are ineffective, as subcontractors tend to work on a sub-optimal behavior to protect their interests. On the other hand, if plan reliability in a project is at a high level, the predictability of resource allocation is higher, because subcontractors and project managers tend to assign appropriate resources to projects where they are certain about the work they can perform.

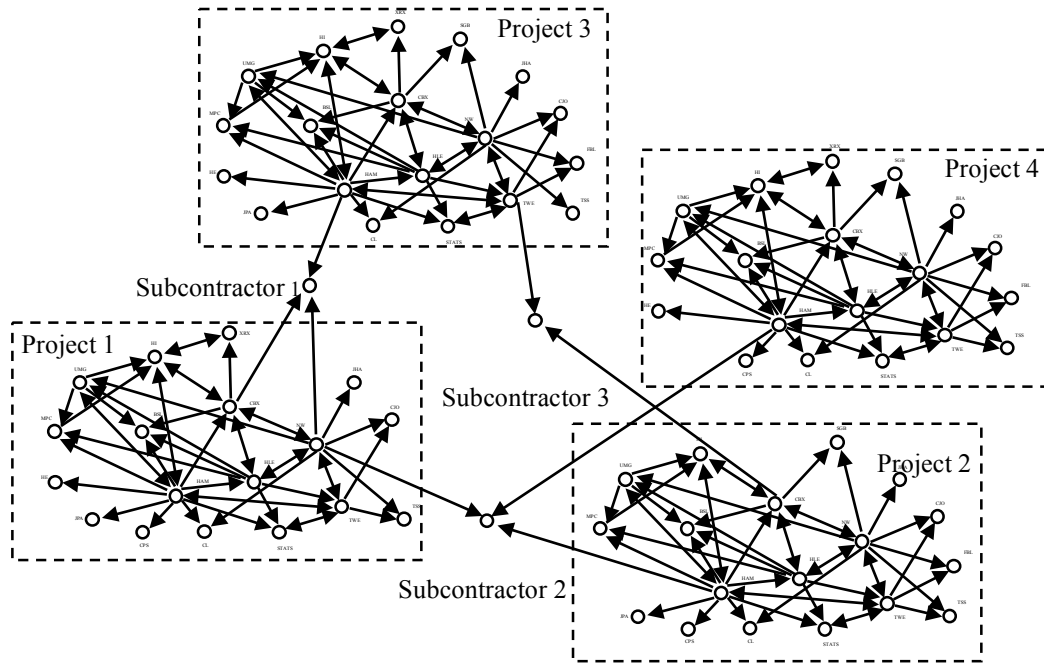


Figure 8. Example of the meta-project, through a Social Network Analysis. Adapted from Pryke (2004)

Section 2.1 states that subcontractors are an example of stakeholders acting as AAs in critical situations of construction projects (Fernández-Solís 2008). In this case, subcontractors allocate resources between their different undergoing projects, based on the local plan of a project per contract and a game plan to maximize profits and minimize risks, taking into consideration what is happening in other projects. Subcontractors behaving as AAs are making these decisions based on their individual strategic plans, in response to the general economy: in good times, grow to survive the next downturn and in bad times, survive to grow when the economy turns (Fernández-Solís et al. 2015). They strive to maximize their workload between different undergoing projects, so they can optimize their resource allocation (O'Brien and Fischer 2000).

Sacks and Harel (2006a) suggest that the use of the LPS improves plan reliability, by making the plan of “our” project transparent to all stakeholders, thus increasing resource allocation reliability. How does this work? Like an army platoon, all the foremen and group leaders meet, parcel out their work, check who goes before and after their work, and bond as a team to mark “our” project work as planned. So, when a subcontractor has another project on “fire,” the foreman or group leader is the first line of defense: “you want to reduce my workforce to put out a ‘fire’? Take them from another non-lean project.”

Sacks and Harel (2006a) proposed a possible solution to the problem of the behavior of subcontractors acting as AAs and affecting the performance of the LPS, which consists of controlling the contractual terms related to remuneration. The basic idea of this possible solution is to reserve part of the contract remuneration to cover subcontractor capacity, thus allowing managers achieve project optimization, rather than independent local optimization.

Fernández-Solís (2015) proposes a strategic system similar to the one used in Safety. The system focuses on assessing the performance of construction companies, to create a standard of this type of assessment. After the standard is created in the industry, a paradigm shift occurs in economic models for acquiring projects, as owners would be able to identify companies with reliable performance, thus creating a new factor in projects assignments. This paradigm shift occurred with Safety, when the Occupational Safety and Health Administration (OSHA) created safety performance standards for construction.

3. RESEARCH METHODOLOGY

The research objective of this thesis is to answer the question: does the stakeholder AA, gaming in the general economy, affect the performance of the LPS, thus affecting the impact of LC in the construction industry? The first step to defining this objective was conducting a Structured Literature Review (SLR) to discover similar research, identify a research question and explore a possible methodology.

3.1 STRUCTURED LITERATURE REVIEW PROCESS

As per Leedy and Ormrod (2010), the SLR is a phase of the research process that reviews what others have done in similar areas of knowledge, however, it does not necessarily need to be about the identical topic of investigation. The SLR describes theoretical and empirical perspectives, about previous findings related to the research topic (Leedy and Ormrod 2010). Naoum (2012) defines five main steps to conduct an SLR: (1) identify sources of information; (2) understand how the sources work; (3) collect and review existing publications on the topic; (4) systematically organize the publications; and (5) assess and write up the literature review.

For this study, step (1) involved the publication sources definition, with appropriate sources for this specific topic being: Google Scholar, The Texas A&M University Libraries, the *Lean Construction Journal*, the American Society for Civil Engineers (ASCE) Library, the Engineering Village database, The Taylor & Francis

database, and The Emerald Insight database. These sources would lead to papers, books, webpages, and many other types of publications related to the topic.

As part of step (2) in the SLR process, and since all sources are electronic databases, a set of keywords were defined to conduct the investigation in the search engines. Keywords are: Construction, Lean, Last Planner System, Productivity, Autonomous Agent, Subcontractor, Self-interested, General Economy, Game Theory.

Step (3) consisted of performing searches in the sources with different combinations of the predefined keywords, which led to a significant number of publications regarding the topic. Relevant publications were reviewed and systematically organized as part of step (4). Three rounds of searches with all possible combinations of keywords were performed in the sources to find relevant publications. Step (4) required organizing the publications through a deep review of content. Extra publications were identified in the reference sections of the relevant publications, which led to a new set of publications. Publications were filtered by judging the journal quality, as per the “Journals of Quality” guide provided by the Department of Construction Science at Texas A&M University.

Step (5) consisted of creating the writing outline, analyzing publications for each outline item and finally writing up the SLR. The SLR was critiqued by the researcher, the committee chair, and a colleague. Findings of the SLR are: (1) identification and support of the specific research question; (2) no evidence of previous research specifically addressing the research objective; and (3) options for the research methodology.

3.2 RESEARCH STRATEGY DEFINITION

As per Leedy and Ormrod (2010), there are three main research strategies used in academia:

1. Quantitative research: objective in its methods, procedures and results. It seeks evidence to support or reject a hypothesis, through the analysis of tests that provide hard results. Results are totally quantitative, they cannot be abstract (Naoum 2012).
2. Qualitative research: subjective on any of its means. It tries to find meanings, experiences and descriptions, using a high degree of interpretation (Naoum 2012).
3. Mixed methods research: a strategy that uses qualitative and quantitative means to better define the research topic, when the use of a single method is not enough. This method provides strengths from one or the other of the basic research methods (Leedy and Ormrod 2010).

The SLR indicated a preponderance of similar work with a qualitative approach. However, as the researcher wanted a better outcome of the results and the ability to obtain a more real picture of practitioners' opinions, it was decided to pursue a mixed method research strategy. All qualitative data obtained in the research process could be analyzed through quantitative methods to provide a better degree of certainty to the research objective.

3.3 DATA COLLECTION METHOD

There are two types of data collection methods for this research topic: survey approach and personal interview approach. As per Naoum (2012), a survey gathers data

in a relatively short time frame from a large number of participants. A survey is composed of a questionnaire that is sent to the subjects through different means, such as email, postage, personal delivery, and others. A survey is typically sent to a specific sample of a population with certain characteristics. The second method is through personal interviews, which Naoum (2012) describes as the technique to obtain factual information, as well as opinions, through a set of questions that may be predefined. Personal interviews are typically a face-to-face process, in which the interviewer asks questions of the interviewee to better define the research hypothesis. The researcher created Table 1 which contains the characteristics applicable to this research topic for each data collection method.

Table 1. Data collection methods applicable to the research topic

	Survey	Personal Interview
Speed	High	Low
Accuracy of results	High	High
Participation of field individuals	Low	High
Traveling requirements	Low	High
Paperwork for accessing sites of research	Low	High
Institutional Review Board (IRB) approval required	No	Yes

As per Table 1, it is evident that conducting surveys has several benefits in speed and paperwork required. However, after discussing the pros and cons with the researcher's committee chair, Dr. José Fernández-Solís, it was determined that it would be beneficial

for this research topic to have the input from as many field practitioners as possible, which would be a challenge to obtain through the use of surveys. For this reason, the decision was made to collect data through personal interviews. This decision required IRB research approval as discussed in section 3.8.

3.4 QUESTIONNAIRE CONSTRUCTION

As per Knight and Ruddock (2009), there are two types of personal interviews: structured interviews and unstructured interviews. Structured interviews are performed by one person asking a list of predetermined questions to another person, with the objective of finding an opinion about the research objective (Knight and Ruddock 2009). Unstructured interviews involve the exploration of a concept without predefined questions; the interviewer ask questions related to the research objective, but in an open form, with the information flowing as the topic is discussed (Knight and Ruddock 2009). For the purpose of this research topic, it was decided to use a structured interview, as the intent was to analyze the results through quantitative methods.

The design of the questionnaire was based on the process proposed by Naoum (2012) and Kvale (2008). The first step in the process was to define the research objectives through the SLR. The second step was to identify the main issues, topics and ideas to clarify through questions. The last step was to define the specific questions to be included in the questionnaire, which address the main issues, topics and objectives. Figure 9 explains the process.

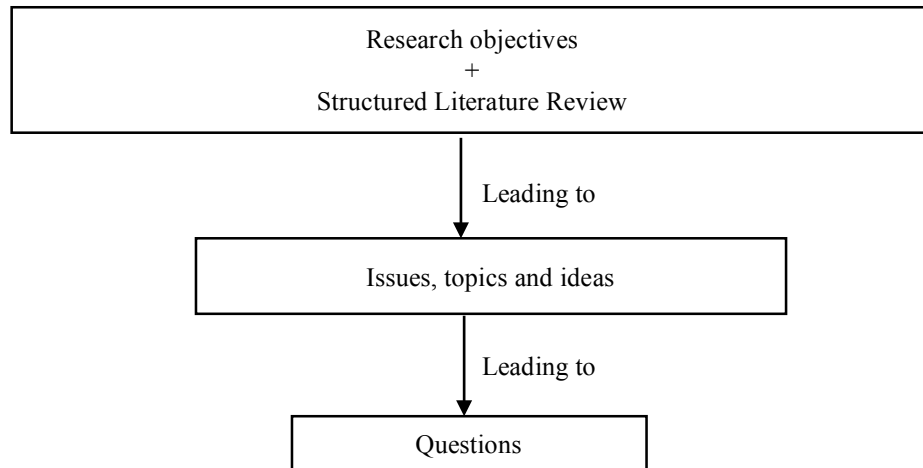


Figure 9. Questionnaire construction diagram. Adapted from Naoum (2012)

There was a process of reviewing the final questionnaire with input from the committee chair, Dr. José Fernández-Solís. Next were the data objectives for each section of the questionnaire. The final questionnaire is included as Appendix B:

- Section 1. Define subject's background.
- Section 2. Clarify the previous subject's knowledge and experience with LC.
- Section 3. Clarify the previous subject's knowledge and experience with the LPS.
- Section 4. Evaluate if the AA is a potential issue for the project.
- Section 5. Understand the performance of LC, the LPS and the AA on this project.

The questionnaire consists of 29 questions and 5 sections. Section 1 defines the subject's background to confirm its characteristics. Sections 2 and 3 are introductory parts used to define the subject's knowledge about LC and LPS. Section 4 contemplates the effects of AA in projects, which is the main objective of this thesis. Section 5 has questions from sections 2 to 4 to identify their specific effects in the current analyzed project.

3.5 INTERVIEW RECRUITMENT PROCESS

An intensive recruitment process was followed to ensure enough subjects and projects were secured to create significant outcome for the data analysis. With the support of the committee chair, Dr. José Fernández-Solís, stakeholders of eight companies were contacted to present the research project and request their participation in the study. Additional sources for company recruitment included: Texas A&M Construction Science events, the Lean Construction Education Program sessions from the Associated General Contractors of America (AGC) organization, the 18th Lean Construction Institute (LCI) Congress, and personal contacts. The target companies possessed the following characteristics:

- General contractors.
- Based or with offices in the State of Texas, U.S.
- Held experience in LC.
- Currently had LC commercial projects underway in the State of Texas, U.S.

The researcher found no evidence from previous research to define the minimum number of interviews needed for significant results on this type of study. In this case, two measures were established to address this definition: (1) discussions with the committee chair led to an understanding that this type of study requires a minimum number of 50 interviews, and (2) the individual statistical results are to be tested individually with the proper statistical methods.

Section 4.1 includes the attributes of the companies, projects and individuals that participated in the study. All interview procedures, forms and questionnaires were pre-

approved by the Texas A&M Institutional Review Board (IRB) as further discussed in section 3.8. All personal information of the interviewees and companies' information were handled with strict measures as requested by the IRB, to avoid confidentiality issues.

3.6 SCOPE OF STATISTICAL ANALYSIS

The interviews were followed by a qualitative and quantitative analysis, with a subsequent statistical analysis.

3.6.1 Phase 1: Qualitative analysis of the interviews

All 74 interviews were transcribed and are included as Appendix E in this thesis. The interviews were randomized using Monte Carlo methods. Transcriptions include sections 2, 3, 4 and 5 as indicated in section 3.4. All sensitive information was deleted from the transcription such as names, places, dates, or any information that could lead to the identification of interviewees or companies. Section 1 of the interviews was not transcribed as it contains sensitive personal information of the interviewees.

For the quantitative analysis, all answers for each question were analyzed for content and simplified to a single word that describes the whole meaning of the answer. The assigned words became the input of a matrix composed of questions and the synthesis of all answers. Next is an example of such analysis:

Question:

What are some of the challenges of implementing LC in projects?

Answer:

Challenges range from people wanting to do things the way they've always done it, nobody wants change, change is difficult. I think that's probably the biggest thing that we run into this business. They say why would I need to change? How the sticky notes on the wall will help me make more money? As soon as they see the benefits for them, most people get on board.

Synthesis:

“Change”

In the previous example, “Change” is the word that describes the interviewee’s answer. Subsequently, all answers to the same question meaning the same idea were marked with the word “Change,” such as resistance to change, difficulties with cultural change, try LC but go back to traditional methods too soon, difficulties with onboard adaptation and others. In some cases, answers suggested two or more synthesized answers- all of them were included in the matrix. The same procedure was applied to the answers from all 74 interviews. In the cases of the interviews conducted in Spanish, the synthesized words were translated into English. This procedure standardized all answers into categories for trend identification, and allowed a quantitative and qualitative data analysis.

3.6.2 Phase 2: Quantitative analysis of the interviews

To answer the main research question through the answers in the interviews, a set of subtopics was defined. Subtopics structure the answer for the main research question. Subtopics seek to define if one example of the AA, the subcontractor, affects the performance of the LPS. Next are the subtopics:

1. Define if subcontractors are behaving as AAs in LC projects and can be considered as such for the rest of the analysis.
2. Define if the LPS prevents or manages the behavior of AAs in LC projects.
3. Define if AA behavior of subcontractors is affecting the LPS performance in LC projects.

Each research subtopic was analyzed with different considerations, as it is necessary to conduct appropriate interpretation of the answers in the questionnaire. The interpretation related to each subtopic was necessary because there were no direct questions answering the research subtopics. The reason is that the questionnaire was designed in such a way that any individual at the job site, with any level of education, could answer the questions with no problem, and still provide the factual information objective of this study. Statistical analysis is performed on each subtopic, so confidence about the trends could be obtained. Test Probabilities and Confidence Interval statistical tests were used as data is composed of fractions. JMP 12 is the software used throughout the study to perform the statistical analyses.

3.6.2.1 Research subtopic I

The first research subtopic is: Define if subcontractors are behaving as AAs in LC projects and can be considered as such for the rest of the analysis. To address this topic, question 21 in the questionnaire fully described the situation in the research subtopic. Question 21 describes the typical situation in which subcontractors act as AAs by relocating resources of the current project to another project where they have difficulties,

a decision that ultimately affects the current project performance. Possible synthesized answers to this question are Yes (in favor), No (against), and N/A (no answer). The N/A answers were dismissed from the statistical analysis, as they provided no information in favor of or against the topic.

Two statistical analyses were performed: Test Probabilities and Confidence Interval to verify the results of the first test. In this case, the null hypothesis to test through a statistical analysis is whether the probability of obtaining the answer of the variable “Yes” is at most 0.5. If the null hypothesis can be rejected with 99% confidence, then the proportion of successes of the variable “Yes” is the majority in the population fraction with 99% confidence. In other words, there is 99% confidence that the majority of the population supports the idea that subcontractors behave as AA.

To verify the statistical results of the first test, a CI was tested for each answer with an α error of 0.05. If the null hypothesis was rejected from the first test, then the Confidence Interval should be greater than 0.5 to confirm that with 95% confidence the proportion of successes in the population fraction of the variable “Yes” is within those limits, hence a majority in the answer of the population. A one-sided sample size test was conducted with the probability of the variable “Yes” with an α error of 0.05, 80% power and H_0 of 0.5, to verify the statistical significance of the results with the total sample size.

3.6.2.2 Research subtopic II

The second research subtopic is: Define if the LPS prevents or manages the behavior of AAs in LC projects. To address the answer to this topic, question 23 describes

the situation in the research subtopic. Question 23 asks directly if the LPS practices prevent the behavior of subcontractors behaving as AAs in LC projects. Possible synthesized answers to this question may be Yes (in favor), No (against), and N/A (no answer). The N/A answers were dismissed from the statistical analysis, as they provided no information in favor or against the topic.

During the interview process, the researcher noticed a trend in the answers to question 23, specifically an alternative answer or explanation to the original question. Many of the interviewees indicated that even when they did not think the LPS prevents the AA behavior of subcontractors, they did think the LPS supports them in managing situations due to the AA behavior. For example, if a subcontractor needs to relocate manpower from a LC project to another project with a “fire,” the LPS does not help the LC project prevent that, but it supports the management or alleviation of the situation. Consequently, during the interviews analysis, the researcher added part B of question 23: Do you think the LPS helps you manage the issue when subcontractors underperform as per the situation in the previous question? Possible synthesized answers to this question are Yes (in favor), No (against), and N/A (no answer). The N/A answers were dismissed from the statistical analysis, as they provided no information in favor or against the topic. Part B of question 23 was not an expected outcome, because the researcher expected only an answer about the “preventive” capabilities of the LPS with AA behavior.

There are two statistical analyses conducted on questions 23 and 23-B: Test Probabilities to confirm if the null hypothesis can be rejected and a Confidence Interval to verify the results of the first test.

In the case of question 23, the null hypothesis is whether the probability of obtaining the answer of the variable “No” is at most 0.5. If the null hypothesis can be rejected with 99% confidence, then the proportion of successes of the variable “No” is the majority in the population fraction with 99% confidence. In other words, there is 99% confidence that the majority of the population supports the idea that the LPS does not prevent the behavior of AA in subcontractors. The statistical tests performed in this case are the same as in section 3.6.2.1 but analyzing the variable “No.”

In the case of question 23-B, the null hypothesis is whether the probability of obtaining the answer of the variable “Yes” is at most 0.5. If the null hypothesis can be rejected with 99% confidence, then the proportion of successes of the variable “Yes” is the majority in the population fraction with 99% confidence. In other words, there is 99% confidence that the majority of the population supports the idea that the LPS helps them manage situations in which subcontractors behave as AAs. The statistical tests performed in this case are the same as in section 3.6.2.1 but analyzing the variable “Yes.”

3.6.2.3 Research subtopic III

The third research subtopic is: Define if the AA behavior of subcontractors is affecting the LPS performance in LC projects. To address the answer to this topic, a two part analysis was conducted.

Part 1 of the analysis involves question 19 of the interview questionnaire as it describes the situation in the research subtopic. Question 19 describes the situation in which the self-interested behavior of subcontractors permits them to really buy into the

LPS. As there are several possible synthesized answers for this question, such as Yes, No, Eventually, etc., each synthesized answer was categorized as the variable “Effect” if the answer suggests that the behavior of subcontractors affects the performance of the LPS or as the variable “No Effect” if it is the opposite. For example, the synthesized answer of the variable “Yes” was categorized as the variable “No Effect,” because the answer suggests that subcontractors typically buy into the LPS, so their behavior does not necessarily affect the LPS performance. The same procedure applies to the rest of the synthesized answers in question 19. The “no answer” (N/A) answers were dismissed from the statistical analysis, as they provided no information in favor or against the topic.

Part 2 of the analysis involves questions 13, 14, 17, 27, and 28 of the interview questionnaire as they are related to the situation in the research subtopic. Questions 13, 14, 17, 27, and 28 ask about challenges overseen in the LC and LPS practices. Some of those challenges are directly related to the self-interested behavior of subcontractors. As there are several possible synthesized answers in this question, such as training, participation, change, etc., each synthesized answer was categorized as the variable “Effect” if the answer suggests that the behavior of subcontractors affects the performance of the LPS or the variable “No Effect” if it is the opposite. For example, the synthesized answer “Change” (meaning reluctance to change) was categorized as the variable “Effect,” because the answer suggests that subcontractors are reluctant to adopt change brought by the LPS, so their behavior affects the LPS performance. The same procedure applies to the rest of the synthesized answers in question 13, 14, 17, 27 and 28. The “no answer”

(N/A) answers were dismissed from the statistical analysis, as they provided no information in favor or against the topic.

There are two statistical analysis conducted for Part 1 and 2: Test Probabilities to confirm if the null hypothesis can be rejected and a Confidence Interval to verify the results of the first test. In this case, the null hypothesis is whether the probability of obtaining the answer categorized as the variable “Effect” is at most 0.5. If the null hypothesis can be rejected with 99% confidence, then the proportion of successes of categorized answers as the variable “Effect” is the majority in the population with 99% confidence. In other words, there is 99% confidence that the majority of the population supports the idea that subcontractors behaving as AAs affect the performance of the LPS since they do not buy into the system. The statistical tests performed in this case are the same as in section 3.6.2.1 but analyzing the variable “Effect.”

3.7 RESEARCH LIMITATIONS

There are several considerations in the scope of this study, directly or indirectly affecting the results.

- The research analyzed only commercial projects.
- Results were influenced by the number of participants in the study. The study comprised 74 subjects, spread across eight projects with four different companies.
- Questionnaire questions 13, 14, 17, 19, 21, 23, 27, and 28, were used for the objective of this research. Future research is proposed with the data of the rest.
- The possible solutions for the problem statement were defined for future research.
- The available literature is representative for this topic.
- The interviewees provided quality information about the problem statement.

3.8 ETHICS AND CONFIDENTIALITY

Texas A&M University has a dedicated department to ensure that all research performed under their supervision is conducted to the proper standards, and complies with all government regulations. The Institutional Review Board (IRB) oversees this activity for the university. The IRB approved the research proposal for tracking purposes with the Study Number: IRB2016-0090D (see Appendix D). The research followed all procedures required by the IRB, which include:

- Proper training for the researchers.
- Submission of an application to the IRB for the study approval.
- Follow up on changes in the study.
- Storage of signed letters of consent from participant subjects.
- Strict securing procedures of personal information from the participant subjects and companies involved.
- After the thesis is concluded, the researcher will follow a close-out procedure as required by the IRB.

As part of the procedures, all personal information, including participants' identities, was kept confidential and secured as per the requirements of the IRB. No participant subject was forced to participate in the study, all of them volunteered to participate and signed the corresponding consent letter. No participant subject was denied the opportunity to participate, as all of them had experience with LC projects, the main requisite to participate in this study.

4. DATA ANALYSIS

4.1 ATTRIBUTES OF PROJECTS AND INTERVIEWEES

Four companies participated in the study. From those companies a total of eight construction projects were visited to perform the interviews. All companies have a national presence in the U.S. The companies' revenues range from \$100 million USD to \$11 billion USD, and sum to a total revenue of \$14.3 billion USD. All projects were using LC and the LPS as their main project management methodology. Projects were located in the State of Texas in the cities of Dallas, Houston, San Antonio and College Station. All projects were visited during 2016. Table 2 presents the general characteristics of the eight projects that participated in the study.

Table 2. Construction projects in the study

Project	Project Type	Size	Budget (USD)
1	New Construction / Remodeling	100,000 sqf	\$45M
2	New Construction	1,500,000 sqf	\$150M
3	Existing space conditioning	200,000 sqf	\$2.5M
4	New Construction	70,000 sqf	\$14M
5	Existing space conditioning	28,000 sqf	\$4.3M
6	New Construction	7,500 sqf	\$3.7M
7	New Construction	227,000 sqf	\$31M
8	New Construction	2,200,000 sqf	\$360M

A total of 74 interviews were performed along the different projects, directly with project participants. The interviews were completed at the construction job sites or at the company's office. Only four interviews were conducted by phone, due to time constraints of the interviewees' schedules. The interviews were conducted in both common spoken languages in the construction industry in the U.S., English and Spanish, with the selection depending on which language was more comfortable for the interviewee. A total of 61 interviews were conducted in English and 13 in Spanish. Table 3 presents the general characteristics of the interviewees.

Table 3. Interviewees' demographics

Data	Characteristic
Number of interviewees	74 – Total
Field or Office?	48 – Field Participants 26 – Office Participants
Last Planners?	24 – Last Planners 50 – Non-Last Planners
Years of experience in construction	Range: 1 year – 40 years Average: 17.8 years
Number of LC projects of experience	Range: 1 project – 20 projects Average: 3 projects

Table 3. Continued

Data	Characteristic
Position of interviewees	<p>Tactical</p> <ul style="list-style-type: none"> • Foreman (Regular and General) • Superintendent (Senior, General, MEP and Assistant) • Project Engineer (Regular and Assistant) • Intern • Safety (Coordinator and Manager) <p>Logistic</p> <ul style="list-style-type: none"> • BIM (Coordinator and Engineer) • Project Manager (Regular, Senior and Assistant) • Lean Specialist • Lean Consultant <p>Strategic</p> <ul style="list-style-type: none"> • Project Executive • Vice-president • CEO

4.2 ANALYSIS OF SUBTOPIC I

The first research subtopic is: Define if the subcontractors are behaving as AAs in LC projects and can be considered as such for the rest of the analysis. The qualitative analysis for question 21 (see Appendix B) found only Yes, No and N/A answers, Table 4 shows the number of counts for each answer.

Table 4. Statistical analysis of subtopic I

Frequencies		Test Probabilities					Confidence Intervals		
Level (Variable)	Count	Prob	Hypoth Prob	Binomial Test	Hypoth Prob	p-Value (BT)	Lower CI	Upper CI	1-Alpha (CI)
No	5	0.06757	0.50000	-	-	-	0.029204	0.148612	0.95
Yes	69	0.93243	0.50000	Ha: Prob (p>p1)	0.50000	<0.0001	0.851388	0.970796	0.95
Total	74	1.0000							

In the quantitative analysis, as shown in Table 4, the outcome in the Test Probabilities indicated a P-value of 0.0001, so the null hypothesis can be rejected with 99% confidence. This result indicates that there is 99% confidence that the majority of the population supports the idea that subcontractors behave as AA.

The Confidence Interval for the variable “Yes” is 0.851388 to 0.970796, as shown in Table 4. Since the interval limits are greater than 0.5 evidence indicates that for such data the Confidence Interval is within the range above 0.5, hence a majority in the

population fraction with 95% confidence. This result concurs with the findings in Test Probabilities.

The one-sided sample size calculation resulted in a sample size of 7 with 80% power and 95% confidence. Since total sample size is 74, there is no problem with the experiment design.

4.3 ANALYSIS OF SUBTOPIC II

The second research subtopic is: Define if the LPS prevents or manages the AA behavior in LC projects. The qualitative analysis for question 23 (see appendix B) found only Yes, No and N/A answers; Table 5 show the counts for each answer.

Table 5. Statistical analysis of subtopic II, question 23

Frequencies			Test Probabilities				Confidence Intervals		
Level	Count	Prob	Hypoth	Binomial	Hypoth	p-Value	Lower CI	Upper CI	1-Alpha
(Variable)			Prob	Test	Prob	(BT)			(CI)
					(p1)				
No	52	0.73239	0.50000	Ha: Prob	0.50000	<0.001	0.61946	0.821472	0.95
				(p>p1)					
Yes	19	0.26761	0.50000	-	-	-	0.178528	0.38054	0.95
Total	71	1.0000							

In the quantitative analysis, as shown in Table 5, the outcome in the Test Probabilities Test indicated a P-value of 0.0001, so the null hypothesis can be rejected

with 99% confidence. This result indicates that there is 99% confidence that the majority of the population supports the idea that the LPS does not prevent the behavior of AA in subcontractors.

The Confidence Interval for the variable “No” is 0.61946 to 0.821472, as shown in Table 5. Since the interval limits are greater than 0.5 evidence indicates that for such data the Confidence Interval is within the range above 0.5, hence a majority in the population fraction with 95% confidence. This result concurs with the findings in the Test Probabilities

The one-sided sample size calculation resulted in a sample size of 30 with 80% power and 95% confidence. Since total sample size is 71, there is no problem with the experiment design.

On the other side, the qualitative analysis for question 23-B (see Appendix B) found only Yes, No and N/A answers, Table 6 shows the counts for each answer.

Table 6. Statistical analysis of subtopic II, question 23-B

Frequencies		Test Probabilities					Confidence Intervals		
Level	Count	Prob	Hypoth	Binomial	Hypoth	p-Value	Lower CI	Upper CI	1-Alpha
(Variable)			Prob	Test	Prob	(BT)			(CI)
					(p1)				
No	6	0.10714	0.50000	-	-	-	0.050039	0.214684	0.95
Yes	50	0.89286	0.50000	Ha: Prob	0.50000	<0.0001	0.785316	0.949961	0.95
				(p>p1)					
Total	56	1.0000							

In the quantitative analysis, as shown in Table 6, the outcome in the Test Probabilities, indicated a P-value of 0.0001, so the null hypothesis can be rejected with 99% confidence. This result indicates that there is 99% confidence that the majority of the population supports the idea that the LPS helps them to manage a situation in which subcontractors behave as AAs.

The Confidence Interval for the variable “Yes” is 0.785316 to 0.949961, as shown in Table 6. Since the interval limits are greater than 0.5 evidence indicates that for such data the Confidence Interval is within the range above 0.5, hence a majority in the population fraction with 95% confidence. This result concurs with the findings in the Test Probabilities.

The one-sided sample size calculation resulted in a sample size of 10 with 80% power and 95% confidence. Since total sample size is 56, there is no problem with the experiment design.

4.4 ANALYSIS OF SUBTOPIC III

The third research subtopic is: Define if the AA behavior of subcontractors is affecting the LPS performance in LC projects. The qualitative analysis of Part 1 (question 19 in Appendix B) found Yes, No, Mixed, Eventually and N/A answers, Table 7 shows the number of counts for each answer. Categorization to each answer is identified, to indicate if the answer represents the behavior of AA affecting the LPS performance. The categorization variable is the one used for the statistical analysis as shown in Table 8.

Table 7. Qualitative results of subtopic III part 1

Synthesized Answer	Counts	Categorization
Mixed (Some Yes, Some No)	28	Effect
Eventually (Eventually Yes)	20	Effect
Yes	15	No Effect
No	9	Effect
N/A	2	N/A

Table 8. Statistical analysis of subtopic III part 1

Frequencies		Test Probabilities				Confidence Intervals			
Level	Count	Prob	Hypoth	Binomial	Hypoth	p-Value	Lower CI	Upper CI	1-Alpha
(Variable)			Prob	Test	Prob	(BT)			(CI)
					(p1)				
Effect	57	0.79167	0.50000	Ha: Prob	0.50000	<0.0001	0.684307	0.869479	0.95
				(p>p1)					
No Effect	15	0.20833	0.50000	-	-	-	0.130521	0.315693	0.95
Total	72	1.0000							

In the quantitative analysis, as shown in Table 8, the outcome in the Test Probabilities indicated a P-value of 0.0001, so the null hypothesis can be rejected with 99% confidence. This result indicates that there is 99% confidence that the majority of the population supports the idea that subcontractors behaving as AAs affect the performance of the LPS since they do not buy into the system.

The Confidence Interval for the variable “Effect” is 0.684307 to 0.869479, as shown in Table 8. Since the interval limits are greater than 0.5 evidence indicates that for such data the Confidence Interval is within the range above 0.5, hence a majority in the population fraction with 95% confidence. This result concurs with the findings in the Test Probabilities.

The one-sided sample size calculation resulted in a sample size of 18 with 80% power and 95% confidence. Since total sample size is 72, there is no problem with the experiment design.

The qualitative analysis of Part 2 (questions 13, 14, 17, 27, and 28 in Appendix B) found several different answers; Table 9 shows the counts for each answer. Appendix C contains the explanation with keywords of each synthesized answer. Categorization to each answer is identified, to indicate if the answer represents the behavior of AAs affecting the LPS performance. The categorization variable is the one used for the statistical analysis as shown in Table 10.

Table 9. Qualitative results of subtopic III part 2

Synthesized Answer	Counts	Categorization
Buy	31	Effect
Training	28	Effect
Participation	24	Effect
Change	19	Effect
Overwhelming	17	Effect
Commitment	12	Effect
Setup	11	No Effect
Keep	11	No Effect
Standard	10	No Effect

Table 9. Continued

Synthesized Answer	Counts	Categorization
Flexible	8	Effect
Late	7	No Effect
Tech	7	No Effect
Small	7	Effect
Management	5	No Effect
Language	4	Effect
Manpower	4	Effect
Curve	4	Effect
Assessment	4	No Effect
Link	3	Effect
Delay	2	Effect
Contract	1	No Effect
External	1	Effect
None	21	No Effect
Vicious	0	N/A
N/A	157	N/A

Table 10. Statistical analysis of subtopic III part 2

Frequencies			Test Probabilities				Confidence Intervals		
Level	Count	Prob	Hypoth	Binomial	Hypoth	p-Value	Lower CI	Upper CI	1-Alpha
(Variable)			Prob	Test	Prob	(BT)			(CI)
					(p1)				
Effect	164	0.68050	0.50000	Ha: Prob	0.50000	<0.0001	0.619192	0.73614	0.95
					(p>p1)				
No Effect	77	0.3195	0.50000	-	-	-	0.26386	0.380808	0.95
Total	241	1.0000							

In the quantitative analysis, as shown in Table 10, the outcome in the Test Probabilities indicated a P-value of 0.0001, so the null hypothesis can be rejected with 99% confidence. This result indicates that there is 99% confidence that the majority of the population supports the idea that subcontractors behaving as AAs affect the performance of the LPS since the majority of challenges affect the LPS performance.

The Confidence Interval for the variable “Effect” is 0.619192 to 0.73614, as shown in Table 10. Since the interval limits are greater than 0.5 evidence indicates that for such data the Confidence Interval is within the range above 0.5, hence a majority in the population fraction with 95% confidence. This result concurs with the findings in the Test Probabilities.

The one-sided sample size calculation resulted in a sample size of 48 with 80% power and 95% confidence. Since total sample size is 241, there is no problem with the experiment design.

4.5 SUMMARY OF FINDINGS

The research objective of this thesis is to explore whether the behavior of the stakeholder AA that is gaming in the general economy is affecting the performance of the LPS, thus affecting the performance of LC in the construction industry. To conduct this study, three subtopics were defined from the main research objective. Table 11 summarizes the results of the statistical analysis of each of the subtopics.

Table 11. Summary of findings

Subtopic	Variable of Interest in the Results	Bino-mial Test P =	Confi-dence interval (CI)	Interpretation
1. Define if subcontractors are behaving as AAs in LC projects and can be considered as such for the rest of the analysis. (Question 21)	Yes	0.0001	0.851388 to 0.970796	99% confidence that the majority of the population supports the concept that subcontractors behave as AAs. Evidence indicates that for such data, the CI is within the range above 0.5, hence a majority in the population answer of the variable “Yes” with 95% confidence.
2. Define if the LPS prevents the behavior of AA in LC projects. (Question 23)	No	0.0001	0.61946 to 0.821472	99% confidence that the majority of the population supports the concept that the LPS does not prevent the behavior of AA in subcontractors. Evidence indicates that for such data, the CI is within the range above 0.5, hence a majority in the population answer of the variable “No” with 95% confidence.
2. Define if the LPS manages the behavior of AA in LC projects. (Question 23-B)	Yes	0.0001	0.785316 to 0.949961	99% confidence that the majority of the population supports the concept that the LPS helps them to manage a situation in which subcontractors behave as AA. Evidence indicates that for such data, the CI is within the range above 0.5, hence a majority in the population answer of the variable “Yes” with 95% confidence.
3. Define if the AA behavior of subcontractors is affecting the LPS performance in LC projects. (Part 1 – Question 19)	Effect	0.0001	0.684307 to 0.869479	99% confidence that the majority of the population supports the concept that subcontractors behaving as AAs affects the performance of the LPS. Evidence indicates that for such data, the CI is within the range above 0.5, hence a majority in the population answer of the variable “Effect” with 95% confidence.
3. Define if the AA behavior of subcontractors is affecting the LPS performance in LC projects. (Part 2 - Questions 13, 14, 17, 27, 28)	Effect	0.0001	0.619192 to 0.73614	99% confidence that the majority of the population supports the concept that subcontractors behaving as AAs affects the performance of the LPS. Evidence indicates that for such data, the CI is within the range above 0.5, hence a majority in the population answer of the variable “Effect” with 95% confidence.

For the first subtopic, it is evident that the population identifies subcontractors as stakeholders behaving as AAs in LC projects, and they can be considered as such for the rest of the analysis. For the second subtopic, it is evident that the LPS does not prevent the AA behavior of subcontractors. However, it is evident that the LPS is a supportive tool for managing the issue in case it happens. For the third subtopic, it is evident that the AA behavior of subcontractors is affecting the performance of the LPS in projects.

In sum, the main research objective is supported by the results of the three research subtopics. It is then evident that the behavior of AA affects the performance of the LPS.

5. CONCLUSIONS

5.1 SUMMARY AND CONCLUSIONS

This research has demonstrated that the behavior of AA affects the performance of the LPS. Subsequently, if the LPS performance is affected, then LC performance in the construction industry is affected as well. This is one of the reasons why, over the course of more than 20 years of development and implementation, the LC movement has ***not been able to create a significant impact in the productivity*** of the overall construction industry.

The SLR found a flow of concepts and ideas that supported the fundamentals of the research topic such as:

- The general economy is the starting point in the analysis of the AA behavior of stakeholders, using understandings from game theory. These concepts were eventually adopted in the construction industry.
- The current situation of construction productivity is analyzed, by considering the industry efforts to generate improvement in construction productivity, which unfortunately have been relatively unsuccessful.
- New methodologies such as LC, have a huge potential to change the unsuccessful trend of construction productivity.
- The SLR closes with a compilation of different construction economics and construction productivity topics, as the support for the main research objective.

In the methodology section, the main research objective was subdivided into three subtopics for proper analysis through a mixed methods research strategy. The definition of each subtopic supports the main research objective. The data collection came from 74 structured interviews conducted in eight different projects located throughout Texas, led by four different construction companies. A qualitative analysis was performed in the interviews, which led to a quantitative analysis using statistical methods. The results from the statistical tests confirmed the trend in the research subtopics, which served as the basis to confirm the statement about the main research objective.

It is then concluded that the behavior of the stakeholder AAs gaming in the general economy affects the performance of the LPS. This is one of the problems affecting the performance of LC methodologies in the construction industry, and another reason why U.S. construction productivity has stagnated over the last five decades.

5.2 SIGNIFICANCE OF THE STUDY

Findings in this study identified one of the behaviors of stakeholders in construction projects affecting the performance of the LPS, hence the productivity improvement capabilities of LC in the construction industry. This study establishes the grounds, by identifying the problem, for future research of academia and practitioners to reduce the impact of this behavior in the construction industry productivity.

5.3 FUTURE RESEARCH

Through the development of this thesis, several topics and ideas emerged as raw material to be used by academia for the benefit of the construction industry. The first item to discuss is the list of several proposals obtained during the interviews, which address the issue of preventing the behavior of AA in LC projects affecting project performance, due to the inescapable and eventual local resource allocation to external projects. Each proposal should be analyzed for future research. Next is the list with an explanation of the proposals:

1. Demonstrate the financial benefits of LC to subcontractors so they buy into this methodology. Prove that LC saves money and time.
2. Planning manpower requirements in the Pull Planning Sessions.
3. Tracking manpower in the daily huddles and WWP meetings.
4. Establishing a rigorous and standardized pre-qualification process to bid projects with vendors. Include the analysis of capabilities and current load of work.
5. Create a monthly one-day buffer available for the schedule of all subcontractors, so in case they need it, they use it. Reward them if it is not used.
6. Create a strategy that allows trades to relocate resources to external projects, only in the specific cases allowed by buffers in certain specific activities of the current project. The goal is to reduce the likelihood that extraordinary situations will affect the resource allocation of the current project.
7. Assess the effects of having LC and the LPS as requirements in the contract, which may include commitment of manpower or resources.

After reviewing and analyzing the package of interviews, the researcher has concluded that there is much more information that could be obtained from the data. There are several questions from the questionnaire that had no input in this thesis, questions that may be beneficial to other studies. Next is a list of potential research topics for future research, that could benefit from the data in the interviews:

1. Benefits of LC and the LPS (questionnaire questions: 12, 16 & 26).
2. Challenges of LC and the LPS (questionnaire questions: 13, 14, 17, 27 & 28).
3. Perceptions about the LPS complexity (questionnaire question: 18).
4. Solutions supporting subcontractors to buy into the LPS more easily (questionnaire question: 20).
5. What are the traditional methods to handle issues related to AA in construction projects? (questionnaire questions: 22 & 25).
6. What are the inefficiencies of traditional project management methodologies if compared to LC and the LPS methodologies? (questionnaire question: 29).

Finally, the next topics for future research came from the SLR process and further analysis:

1. Bertelsen and Sacks (2007): the construction industry tends to behave as a dynamic complex system, which requires the development of integrated and collaborative frameworks for its stabilization.
2. As indicated by Eastman and Sacks (2008), and Rojas and Aramvareekul (2003), the construction industry needs more research about the labor productivity aspect.

3. As indicated by Koskela et al. (2014), the CPM technique needs more empirical research to confirm its benefits.
4. Sacks and Harel (2006a) proposed a strategy to control the AA behavior in projects, which involves reserving part of the contractual remuneration to cover the capacity of subcontractors, providing more manpower control to managers.

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APPENDIX A

THE GENERAL ECONOMY AND THE CONSTRUCTION INDUSTRY*

As the general economy eventually affects the performance on construction projects (Myers 2013), it is appropriate to start the research journey by understanding the games played in general economy. Figure 10 explains the interaction of the general economy with the microeconomics in construction projects.

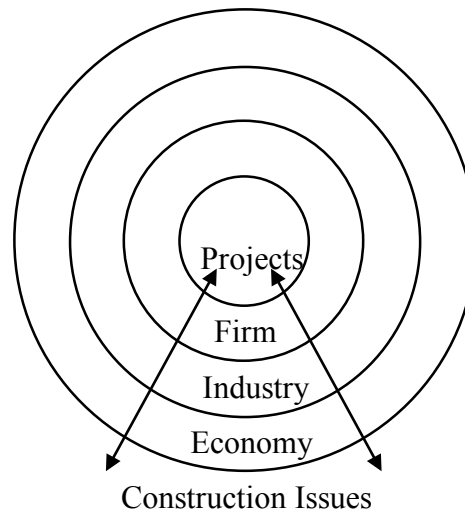


Figure 10. A model for construction economics. Adapted from Myers (2013)

In the construction industry, similar to the way it works in the general economy, the direction of economics is towards the constant distribution of limited resources (Myers

* Part of the data reported in this appendix is reprinted with permission from “Is building construction approaching the threshold of becoming unsustainable: a systems theoretic exploration towards a post-Forrester model for taming unsustainable exponentialoids” by Fernández-Solís, J. L. (2006). Georgia Institute of Technology.

2013). Even when humanity wants infinite resources, the world has a limited amount of the resources required for production (Cleaver 2014). So, the main issue that construction economics face is that there is a fixed set of resources facing a tremendous demand; that situation is properly named scarcity (Myers 2013). Figure 11 explains the resources allocation issue faced by economies, using the world's iron ore reserves and depletion.

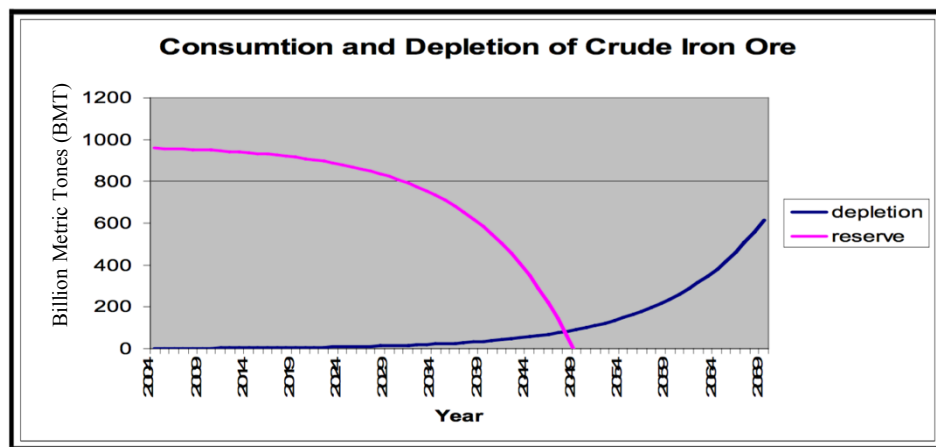


Figure 11. World reserves and depletion of iron ore. Reprinted from Fernández-Solís (2006), with permission

Economists argue that humanity must concentrate on decisions to face the allocation of fixed resources (Cleaver 2014). Those decisions should be based on basic questions such as what is made, how it is made, when it is made, where it is made and for whom it is made (Myers 2013). Applied to the construction industry, the questions are what investments are made, how the investments are built, when they should be built, where they will be built and for whom. Consequently, economics can be referred to as a “choices science” (Clever 2014). When choices are made, other choices should be

abandoned. This means, in a world of scarcity, for every choice that satisfies a need, some other need will remain unsatisfied. Choosing always has a risk, as in the end something else may be lost. It could be an opportunity lost or vanished. To highlight this dilemma, economists call for the concept of “opportunity cost” (Newnan et al. 2012).

Sustainable construction economics considers the use and cost of resources during an entire building life, the life cycle cost (LCC) analysis. The LCC is an economic assessment of a specific system, item, or complete facility throughout its life, which is expressed in its equivalent cost to be used for benchmarking purposes within different options (Dell’Isola and Kirk 2003). Performing an LCC analysis is necessary for the successful development of projects (Dell’Isola and Kirk 2003). With the incremental competition in the market, owners consider this type of assessment very valuable as it will help them find solutions to reduce the total LCC, thus reducing initial investment while still meeting their needs (Dell’Isola and Kirk 2003).

The main problem for construction economics is the complexity of this industry, as complexity makes it difficult when choosing different aspects that should be considered when defining an accurate LCC of an investment. Fernández-Solís (2008) and Pryke (2004) define the construction industry as a complex system due to its inherent non-linearity, affecting construction projects on every aspect. This unpredictability of the construction industry is due to all the degrees of freedom (the number of different paths along which actors can make decisions), multiple components (e.g. labor, materials, equipment, finances, etc.) and multiple variables (intended and unintended) in the industry (Fernández-Solís 2013). Indeed, the construction industry could be complex enough to be

considered a chaotic system, if enough non-linear and non-periodic elements are present in the construction project (Fernández-Solís 2013). The complexity of construction projects may be visually explained by a social network analysis, which defines a project as a network of information exchange relationships (Pryke 2004; Malisiovas and Song 2014). Figure 12 explains the complexity of a construction project by using the approach of a social network analysis.

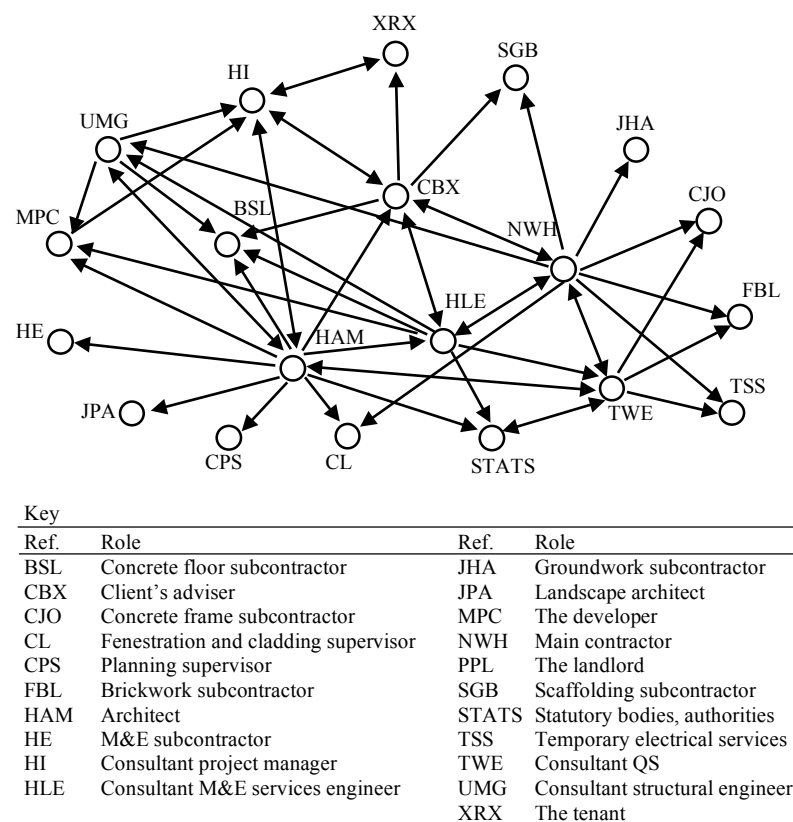


Figure 12. Example of the complexity of a construction project, through a Social Network Analysis. Adapted from Pryke (2004)

The complexity of the construction industry tends to increase the relatedness between stakeholders, and thus the competition between them. As indicated by Basilgan and Christiansen (2014), there are different concepts of economics involving competition factors that need to be explained. The most basic concept of pure economic conflict involves “perfect competition” which requires that all actors receive no influence among them. This is a totally different situation with “pure monopoly” in which there are no competitors at all. Along with the two mentioned perfect concepts of economic conflict, there is the concept of “imperfect competition,” in which a strategic interaction exists within the different economic actors, such as in duopoly or oligopoly. A more complex concept to study in practice is “cooperation,” which is commonly seen in public goods or common-pool resources. Basilgan and Christiansen (2014) argue that such cooperation is seen through institutional evolution, involving cooperating individuals who are acting outside of the body of the formal government. The interaction between the different economic competition concepts push actors to behave as suggested by game theories.

As indicated by Parsons and Wooldridge (2002), the basic concept of game theory comes from a branch of economics that studies interactions between self-interested agents (or AAs, as explained later). It is similar to decision theory, sharing many concepts of its development and having its fundamental grounding in the work of Neumann and Morgenstern (Parsons and Wooldridge 2002). As suggested by its name, the basic concepts of game theory come from studies of games, like chess and checkers. During the evolution of theory analysis, it became known that game theory can also be applied to the interactions occurring between agents defined as self-interested. Parsons and Wooldridge

(2002) mention the classic question in game theory when multiple AAs are involved: What is the most rational and best choice an agent can make? In scenarios when multiple agents interact, the overall result will be greatly affected by the choices made by the different agents involved. Therefore, the corresponding logical decision of an agent in this situation is to reason strategically in order to obtain the optimal result, in response to the cycle position of the general economy (good times and bad times cycles). This means that the best strategic decision requires the assumption that every competing agent will make the best choice to optimize its own outcome. Game theory can structure all mentioned scenarios to formalize the concerns, thus analyzing all possible outcomes (Parsons & Wooldridge, 2002).

Myers (2013) suggests that there are many reasons why in recent years, economists are using game theories to study collusion. As per Cleaver (2014), collusion is the action, usually of a cartel, of conspiring against consumers to increase prices, revenues and profits. The importance of collusion is represented, for instance, in strategic competition between firms. Typically, any firm defines its own strategy to handle the game plan, but in the end, even when it may have the best planned outcome, the final result will depend greatly upon the plan of its competing firms. For example, several companies compete through a competitive bidding solicitation process, but only one is selected to do the project. There is an internal not reimbursed cost to submit a bid proposal by each company. This is the equivalent of money posted to participate in a casino game, only the winner recuperates the money.

Game theories have greatly proliferated since 1994, when three game theorists shared the economics Nobel Prize; since then many applications have been implemented in general research (Myers 2013). Such an example is the famous prisoners' dilemma, which is used to demonstrate that competition between firms always reflects a conflict of interests, which is not necessarily resolved by an integrated tacit agreement. Hence, within the typical competition of work through a tendering process the zero-sum game concept may apply, a concept that considers a fixed term of total winnings, resulting in some winners and some losers (Myers, 2013). Figure 13 explains the game theory concept through a tree of choices: player A has options f and g, and acts first, then player B has options h and j and acts after player A, having a game outcome of 4 different choices.

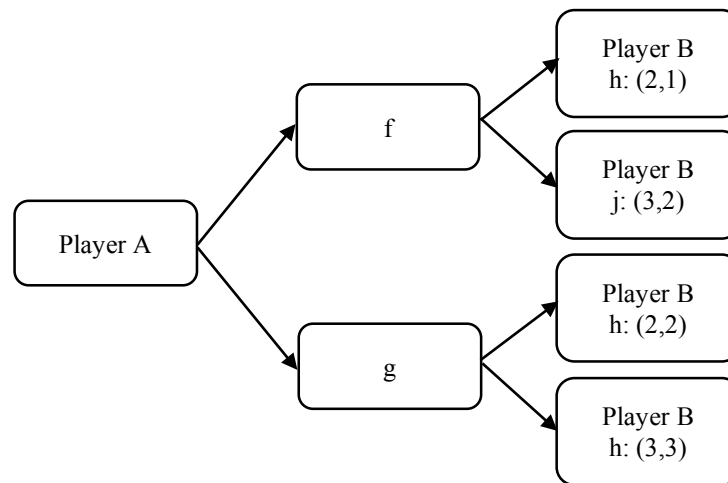


Figure 13. Example of an extensive game. Adapted from Basilgan and Christiansen (2014)

Basilgan and Christiansen (2014) state that the mathematical analysis of game theory is derived from applying formal modeling. Formal modeling finds the most

possible prediction of results, and identifies the optimal strategies to solve the problem. Basilgan and Christiansen (2014) call for different branches of game theory. One branch is called “bargaining” theory, which involves negotiation between the economic actors, derived into a form of business, similar to the business-union wage negotiation. A branch called “evolutionary” game theory applies when strategies are used in models by trial and error, which creates an economic actor that is learning about the strategies’ outcomes over time. Such branches indicate that formal game theory involves static characters, in contrast to bargaining or evolutionary theories, which require dynamic characters having learning processes and different paths in their evolution. Such dynamic behavior in bargaining and evolutionary learning phases creates a constant change in outputs and institutional arrangements (Basilgan & Christiansen, 2014). The different branches of game theory may accurately predict the behavior of competing agents in complex systems such as the construction industry, even though its analysis is complex as well (Pengcheng and Jiahui, Z. 2012)

Construction game theory is important as it involves modeling behavior with the use of tools for decision making. If general economics is essentially focused on making the best choices, construction game theory follows the same direction. Burkey (2013) states that the main difference in game theory with economics is the consideration of multiple AAs in every scenario, who are making multi-dependent choices. This means the best outcomes in the decisions of person A will depend greatly on the decisions and outcomes of person B and the other way around (Burkey, 2013).

Franklin and Graesser (1996) define the concept of AA as “a system situated within and a part of an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and so as to effect what it senses in the future”. Fernández-Solís (2008) adapts the concept of AAs to the construction industry in such a way that identifies them as actors in complex systems, behaving as self-interested agents, making isolated decisions, and creating non-linearity in these systems. The AA is present in virtually any level of a construction project structure, from tactical (superintendents, field engineers), to logistic (estimating, scheduling, project management) and finally at the strategic level (Fernández-Solís 2008).

All project stakeholders, owners, design team, general contractors, subcontractors, suppliers and vendors, act as AAs (Fernández-Solís 2008). For subcontractors, the consequence of allocating resources is critical for survival in the game, as they need to maintain profitability under construction contracts. Pengcheng and Jiahui (2012) point out that the level of self-interested behavior of AAs in construction projects depends on the risk level of the project, as their main objective is to prevent risks and achieve the project objectives. Project managers maintain the supervision over subcontractors, otherwise project schedules and the restraint of budgets are not met. Sacks and Harel (2006b) argue that the construction behavior analysis of different stakeholders should consider that typically subcontractors relocate resources as needed not only within the project, but within other projects running simultaneously. Fernández-Solís et al. (2015) call this subcontractor mode of operating a meta-project, a project of projects, with each subcontractor maintaining a universe of projects running in time.

For any instance, the analysis should consider the final goal of any subcontractor, which is to make as much profit as possible. Subcontractors are widely seen as the typical example of AA due to their self-interested behavior (Wang 2010; Sacks and Harel 2006b; Asgari and Afshar 2008; Miller et al. 2012). Sacks and Harel (2006b) affirm that a game theory approach may be applied, considering that the behavior of subcontractors working on multiple projects simultaneously, must also consider social, character, organizational or any other another aspect, dictating an effect on economic and financial matters. The model output will indicate that different projects have different environments, thus controlling for individual productivity levels (Sacks & Harel, 2006a).

APPENDIX B

PERSONAL INTERVIEW QUESTIONNAIRE

Section 1. Personal experience (5min)

1. What is your name?
2. What is your position in the company?
3. What is the name of the company that you work for?
4. For how many years have you worked for this company?
5. Did you have different previous positions in this company?
6. Approximately, how many years of experience do you have in the construction industry?
7. Please provide a description of your main responsibilities on this project.
8. On what type of projects you have previously worked? Please assign approximate percentages to the following categories:
 - a) Commercial
 - b) Residential
 - c) Industrial
 - d) Civil
 - e) Others
9. What percentages can you assign to the quantity of projects types you have participated in?
 - a) Private sector

b) Public sector

Section 2. Basic concept of Lean Construction (5min)

10. Have you participated in LC projects in the past? What projects?
11. What is your understanding of LC culture and practices?
12. What are some of the benefits of implementing LC in projects?
13. What are some of the challenges of implementing LC in projects?
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?

Section 3. The Last Planner System (5min)

15. In your own words, what is your understanding of the LPS?
16. In your experience, what are the main benefits of using the LPS?
17. In your opinion, what are the main challenges of implementing the LPS?
18. In your experience, do you think the LPS is complicated?
19. Typically, do you think subcontractors really buy into the LPS?
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?

Section 4. Understanding the Autonomous Agent (5min)

21. Have you experienced project situations in which the subcontractors underperform, due to external issues or external projects (events that happen in other projects where manpower has to be shifted to accommodate an emergency)?
22. When experiencing underperformance of subcontractors due to external issues and projects, how do you typically handle the situation?

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues in external projects?
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

Section 5. Project specifics (5min)

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the subcontractor is also working on)? How was this situation handled?
26. Do you think the LC practices and the LPS have affected or benefited this particular project?
27. Do you think the LPS was, or is, effectively carried out on this project?
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used. What do you think would be the consequences?

APPENDIX C

KEYWORDS FOR EACH SYNTHESIZED ANSWER

Challenges LC/LPS	Keywords with the explanation
buy	buy-in of subs, GC, owner, consultants, designers
change	resistance to change, cultural change, try but go back to traditional very soon, onboard adaptation
training	lack of training, human capital, hard to identify constraints, training on practical rather than philosophy, no coach to lead, initial training
management	lack of management commitment, higher expectations than reality, office involvement with PM, executives
overwhelming	too many meetings, extra paperwork, extra procedures, hassle, too much time, 5S, time of huddles, no labeling everything, less 6 weeks in LAP
vicious	no learning from PPC, results, LPS, poor use
contract	contracting legal issues or structure
late	late implementation of the LPS, not even during subs bid, should start it asap, implement in design, early all trade involvement in LPS
setup	initial timeframe for implementation, implementation itself, field setup, push first trades in LC, structure of implementation plan, how to handle LPS with 1 sub, special area space for LPS meetings boards, lack of preplanning
participation	lack of participation of stakeholders, attendance huddles, encourage participation, encourage everybody onboard, encourage participation, fight cultural change, look for constant improvement
tech	Stickys disadvantages, BIM issues, more visuals needed, instant communication, effective weekly report

flexible	difficult change plans, hard handle changes, too much change on the plan almost daily, trades linked affecting others, moving target, tight schedule
standard	no standard procedures, pre-info to meetings, management system, no breakdown schedule in small segments, 2 week WWP not enough, implement only parts of the whole system, several ideas of lean
delay	causes delays
commitment	lack of commitment from participants, truthful communication, real commitments, lack preplanning, transparency of accountability, lack of motivation
external	doesn't consider external factors
keep	keeping flow, commitment, no material JIT, successful execution, encourage 5S, keep organization, religious huddles, organize board activities per trade
language	language barrier
small	small trades have a hard time to use LPS, sophistication of sub
manpower	not enough manpower to commitments, or keep up with meetings, or people for planning
link	trades linked, so issues push other trades, communication issues
curve	accurate PPC, pass learning curve
assessment	how to know if you are on the right track? Compare to regular schedules (CPM), put value on lean, record aha moments that create value, show money to subs

APPENDIX D

IRB APPROVAL LETTER

DATE: March 03, 2016**MEMORANDUM****TO:** Jose L Fernandez-Solis
TAMU - College Of Architecture - Construction Science**FROM:** Dr. James Fluckey
Chair, TAMU IRB**SUBJECT:** Expedited Approval**Study Number:** IRB2016-0090D**Title:** Does the stakeholder 'Autonomous Agent' gaming in the general economy affects the Last Planner System performance? A Thesis Research.**Date of Determination:****Approval Date:** 03/03/2016**Continuing Review Due:** 02/01/2017**Expiration Date:** 03/01/2017**Documents Reviewed and Approved:**

Only IRB-stamped approved versions of study materials (e.g., consent forms, recruitment materials, and questionnaires) can be distributed to human participants. Please log into iRIS to download the stamped, approved version of all study materials. If you are unable to locate the stamped version in iRIS, please contact the iRIS Support Team at 979.845.4969 or the IRB liaison assigned to your area.

Submission Components			
Study Document			
Title	Version Number	Version Date	Outcome
questionnaire for interview	Version 1.0	02/23/2016	Approved
Verbal script	Version 1.0	02/23/2016	Approved
Study Consent Form			
Title	Version Number	Version Date	Outcome
Consent Form in English	Version 1.1	02/06/2016	Approved
Consent Form in English	Version 1.0	02/06/2016	Void
Consent form in Spanish	Version 1.1	03/02/2016	Approved
Consent form in Spanish	Version 1.0	02/06/2016	Void

Document of Consent: Written consent in accordance with 45 CF 46.116/ 21 CFR 50.27

Comments:

- This study is approved for 80 participants.
- Research is to be conducted according to the study application approved

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<http://rcb.tamu.edu>

- by the IRB prior to implementation.
- Any future correspondence should include the IRB study number and the study title.

Investigators assume the following responsibilities:

1. **Continuing Review:** The study must be renewed by the expiration date in order to continue with the research. A Continuing Review application along with required documents must be submitted by the continuing review deadline. Failure to do so may result in processing delays, study expiration, and/or loss of funding.
2. **Completion Report:** Upon completion of the research study (including data collection and analysis), a Completion Report must be submitted to the IRB.
3. **Unanticipated Problems and Adverse Events:** Unanticipated problems and adverse events must be reported to the IRB immediately.
4. **Reports of Potential Non-compliance:** Potential non-compliance, including deviations from protocol and violations, must be reported to the IRB office immediately.
5. **Amendments:** Changes to the protocol and/or study documents must be requested by submitting an Amendment to the IRB for review. The Amendment must be approved by the IRB before being implemented.
6. **Consent Forms:** When using a consent form or information sheet, the IRB stamped approved version must be used. Please log into IRIS to download the stamped approved version of the consenting instruments. If you are unable to locate the stamped version in IRIS, please contact the IRIS Support Team at 979.845.4969 or the IRB liaison assigned to your area. Human participants are to receive a copy of the consent document, if appropriate.
7. **Post Approval Monitoring:** Expedited and full board studies may be subject to post approval monitoring. During the life of the study, please review and document study progress using the PI self-assessment found on the RCB website as a method of preparation for the potential review. Investigators are responsible for maintaining complete and accurate study records and making them available for post approval monitoring. Investigators are encouraged to request a pre-initiation site visit with the Post Approval Monitor. These visits are designed to help ensure that all necessary documents are approved and in order prior to initiating the study and to help investigators maintain compliance.
8. **Recruitment:** All approved recruitment materials will be stamped electronically by the HRPP staff and available for download from IRIS. These IRB-stamped approved documents from IRIS must be used for recruitment. For materials that are distributed to potential participants electronically and for which you can only feasibly use the approved text rather than the stamped document, the study's IRB Study Number, approval date, and expiration dates must be included in the following format: TAMU IRB#20XX-XXXX Approved: XX/XX/XXXX Expiration Date: XX/XX/XXXX.
9. **FERPA and PPRA:** Investigators conducting research with students must have appropriate approvals from the FERPA administrator at the institution where the research will be conducted in accordance with the Family Education Rights and Privacy Act (FERPA). The Protection of Pupil Rights Amendment (PPRA) protects the rights of parents in students ensuring that written parental consent is required for participation in surveys, analysis, or evaluation that ask questions falling into categories of protected information.
10. **Food:** Any use of food in the conduct of human research must follow Texas A&M University Standard Administrative Procedure 24.01.01.M4.02.
11. **Payments:** Any use of payments to human research participants must follow Texas A&M University Standard Administrative Procedure 21.01.99.M0.03.
12. **Records Retention:** Federal Regulations require records be retained for at least 3 years. Records of a study that collects protected health information are required to be retained for at least 6 years. Some sponsors require extended records retention. Texas A&M University rule 15.99.03.M1.03 Responsible Stewardship of Research Data requires that research records be retained on Texas A&M property.

This electronic document provides notification of the review results by the Institutional Review Board.

APPENDIX E

TRANSCRIPTION OF INTERVIEWS

TRANSCRIPTION OF INTERVIEWS

Interview #1

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Yes, in another project. For 4 or 5 years.
11. What is your understanding of LC culture and practices?
The whole process from going from planning to pull to actually have the real work.
12. What are some of the benefits of implementing LC in projects?
Probably it gives everybody that is a player on the project, what has to happen, the steps to get to the ultimate goal.
13. What are some of the challenges of implementing LC in projects?
The BIM technology is not there yet.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Communication, getting that promoted, from pull planning to the actual worker doing the work.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
This project, before we had a weekly huddle and on this one, we do daily huddles.
16. In your experience, what are the main benefits of using the LPS?
Daily you get a good idea of what's going on.
17. In your opinion, what are the main challenges of implementing the LPS?
Weekly, too many things happen in one week that may affect you.
18. In your experience, do you think the LPS is complicated?
I don't think it's complicated.
19. Typically, do you think subcontractors really buy into the LPS?
Yes, to a certain point.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
It has to be proven that it's the best system.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yeah.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
It has a lot do with the placement of people and putting the right people in the right spot. People above me know we are short-handed and we try people to get up to date. If the power people moves somewhere else. Then I relegate other people to that area.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I don't think it, I'm not sure if lean whether not demand you on the contract to have certain people. But that would be the only way to make sure have the appropriate amount of people.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Track crew size on the system or the amount of production that needs to happen.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No, I have an adequate amount of manpower.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
n/a
27. Do you think the LPS was, or is, effectively carried out on this project?
Yeah, they are effective.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Instead of being in a build design project, I would rather be in a full design before building the project. so if you have the answer before you start the project, you know exactly what to do. As you go, things change. Better planning.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
A little bit disorganization, not going in the same direction. Here everybody knows the direction we are going.

Interview #2

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my first project.
11. What is your understanding of LC culture and practices?
It's an organization tool to help minimize waste and shorten the schedule and minimize as much as time as possible. Being more organized.
12. What are some of the benefits of implementing LC in projects?
It's great because improves the communication. It's great to get everyone talking. The collaboration is a huge benefit. I've seen it happen. You need to get your work done on a certain time, so every contractor is there for their own scope of work, so they figure it out how to do it with collaboration.
13. What are some of the challenges of implementing LC in projects?
I don't like the fact that people can come in and move the stickys whenever they want, because even when they are not supposed to do that, I've seen people doing that. Because they are ruining the collaboration process. But we have weekly subcontractor meetings that kind of fixes that. But brings it to the surface, because you see who moved the stickys. So you solve it. People try to cheat it. So the only way to track it is just by taking a picture. It would be good to have an electronic document or something. So everybody can check what they want.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
n/a

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
I'm not sure about the difference. I can't remember right now.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a

18. In your experience, do you think the LPS is complicated?
n/a
19. Typically, do you think subcontractors really buy into the LPS?
n/a
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
n/a

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes, in this project. I think it was the opposite, they worked here, but they didn't have enough manpower, so we had to bring another contractor to complete the same scope of work. It was stressful, because in the industry it's all about contracts, making sure everything is documented, so we created another contract for another sub, and do the whole entire process again because that sub was on multiple projects and didn't have enough for our project.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
We got another sub to come here, but it was stressful. But we got it done.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
The pull planning brought that issue to life, so I feel that we wouldn't have really known they had enough people if we weren't talking to each other in the session. So it was kind of a preventive measure, which could have been a tremendous tragedy. So I think the system and the collaboration, helped. However, I don't think it prevents it to happen.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
I don't know.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes, in this project. I think it was the opposite, they worked here, but they didn't have enough manpower, so we had to bring another contractor to complete the same scope of work. It was stressful, because in the industry it's all about contracts, making sure everything is documented, so we created another contract for another sub, and do the whole entire process again because that sub was on multiple projects and didn't have enough for our project.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Pull planning has benefited the project. But everything else is just tedious and a waste of time. I think it's just a check thing. It takes a lot of time, which we could do productive work for the project. it's difficult when not everyone is not on board on lean.
27. Do you think the LPS was, or is, effectively carried out on this project?
I think we are still learning. If you have the right team and everyone is on board, it could be beautiful. Everyone is still transitioning.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

A coach is great. But sometimes we get more paperwork. We are trying to make the owner happy, but also the coach happy. When really the end goal is to make the owner happy and finish the project.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

Behind schedule due to weather conditions. We had a lot of rain, which caused this delay. With pull planning, we were able to recover the schedule with a plan.

Interview #3

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
2 projects in total.
11. What is your understanding of LC culture and practices?
Is kind of like a mindset. To be as efficient as possible. Whether is time or money. Different aspects. In my experience with lean, it's a learning experience.
12. What are some of the benefits of implementing LC in projects?
When lean comes in I can see where all the people who have done this for a long time. Have done it and have the same kind of thought. Some of them have taken it pretty well. They really like it. And there are another people who can't.
13. What are some of the challenges of implementing LC in projects?
Some of the stuff is maybe a little over the top. Starts all the way from the bottom from labeling everything to the top. We try to implement 5S's and deal with it. I don't like some aspects, I think it's a little too much. But for the most part is very useful.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
I feel like sometimes you have people that maybe expect too much. You really look at construction and it's a coordinated chaos. You need the organization, the practices. There is a lot of that because construction is old school.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Trying to plan ahead as possible. Instead of just telling people what to do. We try to involve as many as people as possible. To put a plan that everybody can agree with.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
It is a useful tool when it is implemented correctly. It's all about the trainers and the people doing it. You can do a great pull planning and all these plans. Taking notes all over the place. But if you don't keep your commitments, it's off for sure.
19. Typically, do you think subcontractors really buy into the LPS?
Some really do. And some guys who have never done this before is kind of funny. But once they get passed that point I feel like they do buy into this. They do like it. Because it holds people accountable. You have constantly sticking up with dates.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I would suggest to keep an open mind and get easy into. Don't just jump into the fire. I feel the way we do it here is helpful. We have set up an onboard training. Everybody works together in

teams and we do pull planning and the full training which is helpful. Don't try to force this with people.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
There is a lot of back and forth. A lot of disagreement. It seems like when subcontractors are putting against the corner they will find a lot of excuses of why they can't do the work. Construction is constantly having coordinated, so it's really easy for subs to do it. There is a lot of stuff that's not ready all the time. so they have to work around the clock. When they don't have the resources, and that's is usually excuses.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
There are milestones on the project if we agree on that, the pull plan is your only tool. If you have commitments from people, essentially you will hold everybody's job.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
I don't have a suggestion in the top of my head.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Due to the size of this project demands a lot of coordination and people's input. Lean helps with that. Helps to break it down into small pieces. It's a huge way to get this accomplished right.
27. Do you think the LPS was, or is, effectively carried out on this project?
Yes, very well. It's kind of growing as we constantly look ways to improve. There is a lot of incentives to be more lean. The company has been rewarding us to get involved.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
The label making is excessive. All the labeling we do is a waste of time.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I think it would have been ok. I think there is a lot of people who are experienced. We have done this for so long, so I think we can do it. I don't see that as an issue. I think it has improved the way we do this, more coordinated. There is more stuff that is being done ahead of time. Avoiding rework.

Interview #4

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Este es mi tercer Proyecto lean.

11. What is your understanding of LC culture and practices?
La primera vez que lo miré si me confundí, pero ya ahorita que ya le entendí está bien. Es una ventaja para todos los foremen. Porque ahí tú vas mirando cada lo que lleva cada trade.
12. What are some of the benefits of implementing LC in projects?
Uno se va enfocando, ahí va uno a agarrar toda la información. Eso que hacen para que siga el Proyecto y salgo bien. Le da mucha comunicación.
13. What are some of the challenges of implementing LC in projects?
Hay veces que me pueden pedir un área en una semana y es un reto para mí. En lean no veo cosas a mejorar. Esta perfecto.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
No es tan difícil. Porque en el momento que tengas todo bien organizado, no es difícil.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/s
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, es un Sistema fácil.
19. Typically, do you think subcontractors really buy into the LPS?
La mayoría si se compromete a seguirlo. Por lo que he visto en otros trabajos.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Yo creo que, así como lo hacen está bien, no veo nada para mejorar. El Sistema va día con día. Lo que se va quedando atrás, lo mejoramos para hacerlo al otro día. Cambiamos de planes rápido. Cambiamos prioridades.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Si me ha tocado.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Lo que hacemos es meter más horas. Para sacar el trabajo. Porque hay muchas veces como dices, tienen 3 o 4 trabajos y no tienen gente suficiente y no te pueden mandar, lo que hacemos es a lo mejor un poquito más, a lo mejor 2 horas para sacar el trabajo.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Sí, porque ahí te están diciendo que debes hacer y si no tienes la gente lo ves. Puede ser que mañana en el meeting te piden una sección y es cuando hablo con mi jefe, y digo necesito que me mande más gente para una sección grande.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Sería que te avisaran con tiempo, pero muchas veces a penas lo ponen en tiempo porque se enteran ellos. Prevenir eso, yo digo que mi punto de ver, es prevenir la gente, porque tú vienes a ver el trabajo cuando lo vas a empezar, como yo. Y ya dice cuanta gente, y tú miras y nomas dice ponle

5, y tú pones entonces te buscas apoyo a ti mismo. Por eso pides 2 o 3 mas para que no te atrases. Ni te tengas al super detrás de ti cada rato.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Lo ha beneficiado.
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
n/a
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Yo digo que todavía no llevaríamos gran parte de lo que tenemos ahorita hecho.

Interview #5

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Only in the aspect of what us as a company have implemented it. So we just take some of the aspects, some of the quality points of lean construction and develop it to out projects. Probably we have been using it for 6 years.
11. What is your understanding of LC culture and practices?
Trying to eliminate waste. It could be anything from man hours, waste or material. But the biggest waste is the scheduling side where we try to do on time deliveries. Eliminate man hours associated with it. The scheduling side we implement, pull plan, weekly work plan and monitor daily production.
12. What are some of the benefits of implementing LC in projects?
Trying to get the subs bought into the on time delivery stuff and only bring materials they can install in a week or so, because I've been on some other projects before where we didn't use this system, so they brought all material and stage it, with no place, nobody can do their job, because the access is cut off because the material is stopping them. We have to move the material a lot of times. The other side of it is the scheduling piece where you bring the guys in to sit down and collaborate to go through the pull planning session. Instead of dictating the subs what to do on the schedule. I'm getting their buy in their expertise to understand what we need to do to get this back on time. so we can get better buy in on this process.
13. What are some of the challenges of implementing LC in projects?
The challenges are dealing with the lower level subs, moreover if they are not educated. It's the education and the buy in. a lot of times those lower tier guys come with a language barrier, so try to communicate and get their buy to what the process is being a struggle.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
As I bring in a particular trade I'll break down a particular section or area that I want to focus on. I may be wanting to focus on the structure, or something else. I bring those guys in and every time I do one, I kind of break the meeting open, where the discussion they had not in previous before, so I introduce it to them. A lot of it I'll explain why we do it. And explain what we are trying to

accomplish and why are there. I'd like to break down their activities. Just don't tell me you are going to be here and what you can do. If you break it into smaller pieces or areas is way easier for them. They start figuring it out, thinking about new options, like overlapping activities, extra manpower.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
advanced
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
I find it's probably a little more complicated on their side when they don't buy in into it and don't want to. Some of them don't buy it and cooperate. They don't understand why they need to look in advance three months on the schedule.
19. Typically, do you think subcontractors really buy into the LPS?
It goes back to the education or participation in some of the language barrier with the guys, at first some of they feel they don't need to participate in the meetings. They think they are not the guys who need to be there. In the end, it all goes to make sense. And they start getting buy-in. it's a little bit of struggle. But with the help of others who have been in the process, the slower guy's kind of start participating. If a loose somebody I'll go ahead and kind of excuse them, and maybe I reach out somebody higher, so we get better help.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I always challenge myself and my peers. To what we can do better in order to get better participation of that stuff and it really goes back to time. what I mean by that is the longer introduced in the industry, when they see it in more projects. It took us many years to get to where we are today. And this is not different than that.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes, every day.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
There is nothing in the magic bag of tricks that you can do, especially in the lean stuff. The only thing that typically helps you is your own experience by tracking their schedule and checking they are having proper progress, otherwise you should contact them review this. And try to manage that process. being the bully and try to get them to understand this.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think it may go throw the lean process and pull session, it tries to help them being more successful so hopefully in the end that kind of smooth out, so you can forecast better and put more of those activities. Maybe helping them to save more money. I think it's just being proactive through the process, because you are actually, and what helps along with some of the scheduling process that we do. We are trying to get the full picture of those subcontractors. You try to paint the picture for them, so you can actually see how that work and where it should go. So it turns on that light on. So they can possibly find this may work.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
You do end up running into different scenarios. Obviously, your schedule should be adapted. You got to say hey guys this schedule is not working for us. Let's redo this. Let's resequence it. Let's make it better for us. So as we do that. Then it can smooth things out better. And I have done this many times.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes, every day.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
It has benefited. Just with the subcontractors buy in, they actually make commitments, tracking our schedule on time. one of the biggest milestones is getting the dry in because that kicks out so many more activities. And makes your project look like something.
27. Do you think the LPS was, or is, effectively carried out on this project?
I think so. Getting everybody buy-in, follow up. Tracking it. If you need adjustments do it.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
We had a lot of, this is a design-build project, I should have actually practice some of that lean concept with them and put them through a pull session, to actually put them on committed dates. So it can give me time to actually do it.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Not finishing on time. several things, we have liquidated damages, will cause a hard time with your owner, because he is losing money.

Interview #6

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my first lean project.
11. What is your understanding of LC culture and practices?
Basically is just how we can be more efficient. Get rid of any waste.
12. What are some of the benefits of implementing LC in projects?
More efficient, more productive, waste reduced, not spending time in activities that are not important.
13. What are some of the challenges of implementing LC in projects?
Getting implemented in projects. To get started you have to have a lot of procedures. And sometimes people see that as a waste of time, but they don't see it as a benefit in the long term, maybe at the beginning, that's when you have most of the problems.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
With the subcontractors, some of them are a little resistant. In the meetings, they need to be present at the pull planning sessions. Having them is an issue.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
The only thing that I've seen is the pull planning system.

16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
It is not complicated, it's just hard trying to get the subcontractors to participate, after that, is very easy to understand. So the first step is to get the subcontractors on board.
19. Typically, do you think subcontractors really buy into the LPS?
There are some contractors resistant to the lean process, but we have good subcontractors that are using the system in their fabrication places and is amazing what they are doing in their processes. The bigger subcontractors are the ones that are more open to this process, and they have more experience.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
n/a

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes, that happens, not always, but there are some subcontractors with this issue. In my previous project one subcontractor didn't show up during the week and they called us by Friday and said they need to work on Saturday and they showed up with a lot of guys and trucks to work on Saturday.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
If by a certain time they don't show, you can hold their pay app. I mean that's the last resource, you don't want to have that relationship with the subcontractor, but it's just talking to them, talking to their project manager and see what their issues are. Even they go higher in the level.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
That tool helps us communicate each other, so if other parties involved are present, during the pull planning session and subcontractors, they can see what is ahead, when they need to be here, so that way they can communicate to their senior management they have to be here at certain times. So their PMs can schedule that time. That's the tool I see that can help. If it's implemented correctly and everyone follows that, yeah it can prevent all those fires.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Just communicating with them, it's all about communication, telling them when we are having the pull plan sessions and keep committing to the dates that everyone agrees to during those meetings.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
A lot of the formwork being done somewhere else and then we need it here, they send it here, that's one aspect. They are prefabricating all formwork. So we don't store it here. We don't have a lot of waste of the side, and we have more work area.

27. Do you think the LPS was, or is, effectively carried out on this project?
We can be better, since most of us are new to this aspect, so it's a working progress, but I think that compared to when we started we are in so much better position.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Experiences vary from person to person, but in my case, I still have a lot to learn, but we can always do better.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
There would be no communication, we would be behind in our schedule. Especially with our top subcontractors. So I think the lean practices have made us better communicating with the other subcontractors. I think we would be in a worst situation if we had no implemented this technique.

Interview #7

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
A total of 5 projects.
11. What is your understanding of LC culture and practices?
I would say that I am a very intermediate person as far as implementation of lean. But I'm getting more exposed to it every day.
12. What are some of the benefits of implementing LC in projects?
Getting more involvement out of the subcontractors, more commitment from them, getting them involved in the pull planning and the six weeks look ahead boards, to where they actually come and meet without superintendents. They talk about the work on a regular basis.
13. What are some of the challenges of implementing LC in projects?
Lots of subcontractors that have been in business for years and are very successful in what they do are very reluctant to get involved in the LPS.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Lots of subcontractors that have been in business for years and are very successful in what they do are very reluctant to get involved in the LPS.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
I have a general understanding of what it's supposed to look like. I know how it's supposed to be managed and implemented. However, I don't have the meaning to manage it. I'm intermediate in the process.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
I don't think it's complicated.
19. Typically, do you think subcontractors really buy into the LPS?
It's complicated to sell to the subcontractors, because if they buy in, if you get them involvement and are willing to learn, then the LPS is easy to implement. The problem is when they have zero interest in getting involved.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?

I'm trying to figure that out. I think the only way to get them to buy in, is to help them to be successful in a project like this and make them realize that they were more successful and profitable because of the learn culture and the LPS. I think the proof is in the product. If the focus on the benefits, they will realize what the profits are.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
All the time. Unless you have some commitment from them to meet some critical milestone, based on their projects or schedules, they tend to manage, their work, whoever they feel to manage. The LPS makes them focus on accountability.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
In the old days, you pick up the phone and you yell at their superintendents. That scream will typically get the service. If you don't get the service, you ask the PM to send a letter about nonconformance. Saying they are not meeting the critical milestones dates on their schedules. They need to be back on the project, otherwise, there would be monetary penalties.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Yes. I think the pull plan and the 6 weeks look ahead schedule boards, where they actually have committed to the other subs in the room, that need them to complete their test before their test can be completed. Having visuals that make them accountable, with their names on the stickys, about dates, it makes them realize that's there is a lot out there and there are promises they can't break. People hold more their promises.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
I don't think there is something. I think the system works. I think the people are the only reason that it works. It's just getting their buy in somewhere and in some form. I think it's from the successes from the project from using it, that they would see this little by little, and be more apt to participate.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Benefited. On every project with the LPS, I've seen benefits. Moreover in the repetition activities of projects such as concrete. When we get more close to the project end, there would be more coordination with the LPS.
27. Do you think the LPS was, or is, effectively carried out on this project?
The LPS is carried out effectively as our knowledge allows us to do it. With the training that we have. We continue to make strikes and learning how to better use the system every day.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I really can't think of anything that I would change on the project.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

I think we would have suffered. I don't want to say timewise; I just think organizationally. This is a very difficult small site, there is very little room. There is zero laydown and storage areas and things like that. So I think through the communication and organization of our superintendents with the subs by using the LPS. helping the new trades getting ready to start, would have been better. I think we haven't see the benefits yet, due to the complexity and size of the project. Everybody got a lot of work. We wouldn't be as effective and successful as we were today. But I can't put a timeline. I think the benefits will be seen in the next months of the projects when we close out.

Interview #8

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Yes, we with lean and last planner probably 10 years ago. Ever since we started using those tools.
11. What is your understanding of LC culture and practices?
I think there is a misunderstanding within our industry, they say lean construction, but they don't know what is it. Lean is multiple tools. Maybe IPD, LPS, target value design, etc.
12. What are some of the benefits of implementing LC in projects?
One is prior to lean, the LPS, subcontractors, it was so eye-opening who little planning they did. They show up to work and say what are we going to go? With this, we asked to plan the work and is a huge difference. PM used to create the schedules and manage it, and coordinate, so there were very few people on the site understanding the sequence of the schedule, with lean they understand it.
13. What are some of the challenges of implementing LC in projects?
With the team of superintendents that have been in the industry for a long time. Their old school way of doing projects have struggled with sharing the responsibility of creating the schedule or managing the schedule, from that point that's a challenge. Unsophisticated subcontractors, they don't know how to manage this, they have a hard time. getting them to do the weekly work plan, and participate is a challenge. It was kind of a challenge to get old people to buy in.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
I kind of hit some of that, if we go back 10 years. The initial implementation, we are confused ourselves is that we did like a preday or 2.5-day training session and 2 of those days were lean philosophy, the concept of JIT, and doing that. We did a lot of activities and case study things. At the end of the training, we actually talked about the tools they were going to use, the stickys, the actual LPS, a lot time was spent on the why, not the what. We should have training sessions with the what the actual LPS. we created a bunch of reasons why we didn't have to do it.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
It's made of several elements, like pull planning, the milestone schedules, the weekly work plan, to track how the subcontractor makes the work. You track internally the performance of those subs, how often they do this.
16. In your experience, what are the main benefits of using the LPS?
A variety of level of the system tools is important. For example, I have a lot of projects where the stand-up meetings work very well, and in those meetings they talk about safety, which is not the intent. I definitely say the job does much better when the majority of the activities are done properly.
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?

I don't think it's complicated, I think we made it complicated. When we simplify it, the subs get it. I do think all our personnel can kick it out quickly but subs not really, depends on their sophistication.

19. Typically, do you think subcontractors really buy into the LPS?

A lot of them don't like it, the reason is they get extra work. Some of them are not sophisticated. I had several of them that they appreciate it because they feel the job more organized. So depends on the subcontractor.

20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?

Yeah, the biggest thing is simplifying boards, simplify process, training. it's not easy to do it. Change is difficult, that's what we are doing, trying to change the behavior of them. They got to understand the why and the benefits of it. We have more people trained today than before so it helps.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

Yeah, we have those situations occurring quite often. If that situation happens I don't know if the LPS matters if we use it or not.

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?

There are multiple ways that we deal with that. I think there is probably 2 or 3 stages. First, we sit down with the sub to understand the issue and demand to rectify the problem and bring more people. If continuous to be a problem, we may have to go to a situation to put the subcontract in default and supplement their crews with another contractor.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

When you have a subcontractor without enough resources, whether or not you are using the LPS, isn't going to make a difference. The LPS absolutely would be the first line of notification, if somebody's weekly work plan and their number of employees continue to increase, the LPS will be an evidence for that.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

Yeah, the best answer is preconstruction. With subcontractor selection. One of the things that we do, is we go and we meet with the subcontractors at their office or meet them at a particular jobsite. And really trying to get them to work for a project. when we run that issue, is usually when we did not a good job when we awarded the project.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?

n/a

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?

Everybody that comes to our job and sees our job, it is very clear what we are doing, where we at, and what our goals in the schedule are. I think that communication and the way we are managing the schedule there is an advantage.

27. Do you think the LPS was, or is, effectively carried out on this project?

n/a

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I would like to see better visuals. So when you walk into the subcontractor room, you see exactly the plan. And we started with this, but you don't really know exactly where we are. Just a little better communication.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I think we probably would be over budget and behind schedule.

Interview #9

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my second project.
11. What is your understanding of LC culture and practices?
Using tools to more efficiently and effectively progress the job.
12. What are some of the benefits of implementing LC in projects?
Knowing's and variables going on during a construction site, changes as well, and it's kind of hard as superintendent to keep track of it at all. So it helps them, subcontractors, to organize their work.
13. What are some of the challenges of implementing LC in projects?
I don't know.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
n/a

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
While making the pull plan, it's very hard for management companies to accurately manage how long the trades actually say they are going to take to do a certain project. for instance, this trade says they will take 40 days to do the project, instead, they take 20. I think it will good to have some of they have been around for a long time. And who knows exactly how long it should take to do a certain project. so pull plan is so broad that we had so many other, as far as, the pull plan is completely offset either the six-week look ahead. We have those topics but we have some other topics that need to be coordinated. So I think it will be good for somebody to know every single step of the construction process and that's not in the pull planning. The project from start to finish is not in detail as it needs to be.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
It just depends on the superintendents. Kind of will. Is also better to use all of it. but at the same time. you want to keep the relationship between you and the subcontractors, you don't want to throw things out. It's good to implement all the system, right of the bag, if you implement the six weeks and the implement the PPC, and then lay out a line in the project, your subs have to take it. As well as if you have implemented it right away.
18. In your experience, do you think the LPS is complicated?
A lot of our subs have trouble with it. but once we explain it to them. I think the 3-week dashboard should be updated. Because you have your weeks and your manpower, so, we are there having the input, how many guys they have on each day, it doesn't specifically says, that at first, they put dots, they don't say how many they will have. Within putting a number down as far as how many people they will have on the site that helps, but it's not like being like that on the board.
19. Typically, do you think subcontractors really buy into the LPS?

Mixed.

20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?

Instead of a paper thing, it would be something more technological, so trades have access to the weekly plan, via pdf or something like that. It would help them buy into it more.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

That happens a lot. When bidding a project, the managing company they just go off the price, they don't actually look at the company size or manpower. And so who won the project may have just half the guys that are needed.

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?

One of our trades were behind, so we brought another company.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

I don't necessarily say it prevents it to happen, but it's able to pinpoint the problem to happen. Because it's able to say you are underperforming and you are able to see back what happened. We identified the problem sooner.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

Their contracts prevent that situation to happen. If they are signed by contract to have some people, then that will prevent it. The management company should choose the subcontractor not only on price.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?

Yes, overtaking their work with another contractor.

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?

Benefited, especially in the constraint management. Every company needs to use it. There is stuff out there that is presented every single day in our huddle meetings. So little small things that aren't going necessarily to hold anything, but at the end of the project that stacks up on you, and it's nice to have those constraints in the board to eliminate it one by one. Even if they are not huge milestones.

27. Do you think the LPS was, or is, effectively carried out on this project?

Yes. You could always be more effective, with the actual schedules, the trades and how long, it would take you to do certain projects. That would be one of the more effective ways to implement the system. Knowing exactly how long it's going to take, knowing the proper order to install, like right now we are on this activity, but is it faster enough?

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

Just the communication between you and the subs. It has to be instantaneous. If a change order is issued, they have to know that immediately. Because they can be working on that as we speak, and if it changes and they already finish it, they will go back and redo the work. Kind of a lean board that is shared between everyone. And the superintendent has that system.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I think in a 6-month projection, I think it would have double it easily, I think it would be a year. Because there are so many changes and variables. Even the PM, they are not on site, to check the small details.

Interview #10

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Yes, 2 jobs in total.
11. What is your understanding of LC culture and practices?
We call it the morning huddles. I didn't know the name was lean. Just look ahead, trying to make there is no unseen, that may affect the project. Future, keeping everybody on schedule.
12. What are some of the benefits of implementing LC in projects?
Making sure that all the people are aware so they can complete the tasks they need to complete.
13. What are some of the challenges of implementing LC in projects?
Making sure everybody is there, so everybody can talk to each other and make the huddle work.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Not really, this project is further along with other projects. We are doing underground on the other project.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
I think the whole system works great, as long as everybody is in the meetings, and everybody is working where they are supposed to work.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, at all. I think it's really easy because also Spanish speaking people can see it. that is big enough and everybody can see what everybody is doing.
19. Typically, do you think subcontractors really buy into the LPS?
Yeah, every morning all of them are doing it. it all depends on the attendance.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
n/a

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
I haven't personally, but I'm sure there is something came up.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
You have to talk to their boss. We kind of plan ahead and see where we need more manpower.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
You can prevent that situation. It all depends on what jobs are more important. It's always to the big bosses. If we have to do overtime, we'll do it.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Not really. I can replace people, but that wouldn't mean anything. It's always my boss vs the other guys. It all depends on the importance.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
The benefits are I know what the other trades are doing all the time. how many manpower we need. So you know exactly where everybody is working on. it's just too hard to work on top of each other.
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I don't know. I really don't know what to change. It's a pretty good system.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Going back to my other project, we planned to finish the project in 6 months it ended in 16 months. We didn't use lean. Every project is different. There are always different ways to help the project.

Interview #11

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
No this is my first lean project.
11. What is your understanding of LC culture and practices?
I can see it as being a good tool to use. It gets everyone talk and that's the key.
12. What are some of the benefits of implementing LC in projects?
Getting the guys in the office in the morning and talking each other, we don't need to handle each trade, they are here talking, it takes a while to explain them separately this is what we need to do.
13. What are some of the challenges of implementing LC in projects?
In the beginning is hard to get them to participate. But it's a really good tool for these guys, just on this project I can see the benefits.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
How you want the guys to participate? Do you want them to write on the board, or just asking questions? But in the end, it should get the same response from everybody. The same outcome.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
I think those tools are valuable.

16. In your experience, what are the main benefits of using the LPS?
Having an extra board would be good. It holds them accountable. But everybody seeing this, it makes them go for on the road. So it's a good tool. Holding everybody accountable.
17. In your opinion, what are the main challenges of implementing the LPS?
I would probably not be the one, as I'm new on this.
18. In your experience, do you think the LPS is complicated?
Is not complicated, if you have the general idea what you are looking for to accomplish. If you can sit them down. It's pretty easy.
19. Typically, do you think subcontractors really buy into the LPS?
I think the guys the field know because they can talk to each other. The guys in their company at a high level if they push it, it's going to be a lot easier.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I think it's going to take for the company, probably are going to have to talk to all of them, it is a good tool. And everybody is getting money.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes, we get that, and they need to overextend it. that's probably something we need to look out before we hire subs.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Usually, it takes us to talk to their guys in the field, and then we start sending emails, then will take it higher in their company.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think it goes back to the pull plan, everybody gets committed. We just got to hold those guys accountable. We got to have some kind of tool, so they keep their promises. No, it can prevent it to happen, they are going to do it anyway. They are going to do it whether you have the lean board or not.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
n/a

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yeah, we had one sub with problems with the manpower, so we contacted their PM to get that situation solved.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I think without the lean board, we would have the schedule that we have right now, I've been in projects without this system, and this tool keeps it on the schedule unless you have guys pulled out. It's a good tool.
27. Do you think the LPS was, or is, effectively carried out on this project?
We are still in the learning process. I'm sure it can be improved.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

I think it needs to have some kind of way to handle it when we only have one sub. Do we really need the huddles?

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

We would not make our schedule. If you think about our past experience without lean, I'll go back to scheduling you call the PM, people tell you what you want to hear on the phone. I think the key is the schedule.

Interview #12

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Yes, probably by 4 years now.
11. What is your understanding of LC culture and practices?
I understand quite a bit. What particular aspect? The objective of lean is to increase the value to the customer, reduce waste, and is based on the continuous improvement, and respect for others.
12. What are some of the benefits of implementing LC in projects?
The main benefit is a reduction of waste, through coordination efforts which allow projects work in an efficient manner and also some of that have higher margins, higher quality work, so it has a lot of effects on projects. Reliable planning and execution of the work.
13. What are some of the challenges of implementing LC in projects?
How to educate our partners in the industry to what it is and why we do it. Once you sort of educate them, and they see the systems works and benefit them, then they actually participate in the process with you, but it's getting that initial learning curve that is difficult.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
The primary problem is that we are not contracted or conditioned to work in a collaborative manner. So it is overcoming the existing mindset of what this business usually is, so the way we fight that back is we require on trade partners to commit their foreman and PM to attend to a quick off training, of why we pursue lean, how we expect them to be involved, to help them gain that understanding. Because that's how we tackle that.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
The way we look at it is several steps. That it's the milestone planning, the pull planning, constraints, weekly work planning, and the continuous improvement part, daily huddle aspect. The short answer is the LPS is a documented system by the LCI and we teach the practice.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, I don't think so. I think that it would be ideal that we understand it, and the last planners, are not effective planners, I think it makes it better. I think it's also, we don't literally actual measure success and performance. It is not difficult but it goes to back to have difficult changes.
19. Typically, do you think subcontractors really buy into the LPS?
I think that, what I've seen is that you always some partners struggling with change. That's probably the main issue, change. I still you have you disagree typical distribution, and then you have a large majority who kind of wait to see. We have a majority of buy in. That is the caveat, if we have good buy from the GC staff, then we have good buy-in from the partners.

20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
First convince your GC team about it, then convince the trades about it.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Oh yeah.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
It's difficult. What happens is that the contractor is underperforming, we would escalate that to senior management. And we force them to address the issue. We are working to maintain a reliability in the workflow, one trade can throw that off, for sure.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
No, I think we will use the critical path. Maybe that will fit better. I don't know. It's always going to be a struggle. I can't do it. At least one subcontractor. It's difficult.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
I've worked for many years and we struggle with that. Our trade partners feel that is the way to do it. I think it is always going to be a struggle. When you have a partner that has enough projects and have enough buffer in one project, you can pull some people from that project.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
That project, one of the trades was behind schedule, if you check on those parties, it's a national level trade, they see the benefit of what we try to accomplish, they have helped on the lean process. We as GC want you as a trade to work efficiency. If you make money, we make money. They realized in this process, that becomes a motivator to participate in the program. Proving to the subs that lean saves money is the unicorn or lean construction implementation. In one project the trade partner, say how about if we share the cost of a lean consultant so they can teach us better the system, that was because they preliminary saw the benefits of this, so they were actually glad to invest money on that consulting service.
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
The weather, haha. Their PPC is mostly affected due to weather conditions. I don't know. I don't have an answer right now.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Delays, because usually a lack of communication is found in traditional practices. And also cost overruns, big issues. Managing the schedule keep the use of the tools in a right manner.

Interview #13

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
4 in total.
11. What is your understanding of LC culture and practices?
This is my first job when everybody writes on the board. And I really like it. I like it. you get everybody in the room. I like this process, instead, you have to look for them. They are there every day and talking to each other. And we build the schedule for the next 3 weeks.
12. What are some of the benefits of implementing LC in projects?
I just think it helps the projects, to holding on smoothly.
13. What are some of the challenges of implementing LC in projects?
I can't think of anything.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
In this job, started slowly, and we had some meetings and got behind, but we have a big meeting tomorrow, to try to see if we can recover the delay.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No
19. Typically, do you think subcontractors really buy into the LPS?
I think they do.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I think the way it is right now is fine.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
In this case, there is another trade having problems, so he has manpower problems. At this point, he got us behind because he got to get it done before I can continue my work. So it's like pushing.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
It prevents it, everybody is in the room together talking about the activities in the future, so telling them to be aware of what's coming. To me, the crews should stay on the job, so it can be completed.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
I can't about anything.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes, with another trade, through pushing.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
A little bit of both. I will change my mind, I think it has benefited.
27. Do you think the LPS was, or is, effectively carried out on this project?
I think it's currently ok.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I think it was implemented well.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I think it would be 30 days behind.

Interview #14

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
No, este es mi primero y créeme que es algo muy importante para mí y para la gente involucrada en esto. Hace más fácil el tiempo y la conclusión de los trabajos, principalmente la coordinación.
11. What is your understanding of LC culture and practices?
Generalizando, es una gran ayuda. Porque te hace saber a pesar de, a veces no te das cuenta porque no llevas un control de los días, qué tanto haz avanzado, que te ha detenido, porque pierdes la noción de que tú mente está enfocada en el trabajo. Porque te hace entender que tanto haz avanzado, que te está deteniendo, que va a hacer el siguiente trade, cuando vienes aquí y te lo plasma, tú ubicación y ya saben que van a hacer. Se hace una forma de coordinación entre ellos mismos.
12. What are some of the benefits of implementing LC in projects?
Mas qué nada cuando cumples con tú, eso te da la principal idea qué es a tanta fecha está la construcción, qué tan lejos o que tan temprano estas por terminar tú construcción, sí va a hacer a tiempo o se te va a retrasar, pero ya tienes una base con que respaldarte. Incluso cuando no terminamos, a cierta fecha, sí llovió, no llego el material, porque estuvo ahí, todo eso te da una Buena explicación de porqué paso así.
13. What are some of the challenges of implementing LC in projects?
Cuando no hay manpower, cuando no cumples con tu lean board, tú puedes llegar y tienes tú gente, pero hay que tomaren cuenta que no es tú único trabajo, entices de repente vienes con 10 y pediste 15, cuando nosotros vemos que no estas avanzando, nosotros sabemos por qué. El problema es que traes gente que no tiene experiencia, que es lo que pasa aquí. Te retrasa eso, porque debes tener cuidado en el safety, involucre más cosas que nomás te estés pasando que solo lo que necesitas, pierdes lo que alguien con experiencia puede avanzar en otro lado. Ese es uno, el otro es el material no te llega a tiempo, puede tardar días, por tráfico u otras causas.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
No sabía ni de que estaban hablando, no tenía ni idea, la primera vez que vine fue por qué me dijeron tienes que involucrarte, pero después de meditarlo, seguí viniendo y eso me ayudo a ampliar la visión que tenían a abrirla, y realmente es increíble, quien lo haya inventado es una gran visión. Porque reduce muchas cosas.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Lo he escuchado.
16. In your experience, what are the main benefits of using the LPS?
Estamos de acuerdo a la planificación que se hizo. Cumpliendo con todo. Pero también nos hemos visto, los challenges que tenemos ahí incluyen los atrasos. Son muchos factores, falta de gente, material, a veces no podemos llegar a tiempo por causas. Pero todo esto nos ayuda. Que tan lejos estamos.
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, batallaras la primera semana, pero sí realmente estas interesado y entiendes lo importante que es, sobre todo que lo entiendas, te va a ayudar demasiado.
19. Typically, do you think subcontractors really buy into the LPS?
Algunos lo que he visto, es la primera vez que lo hacen, no están familiarizados. El otro problema es que muchos no lo entienden, por el idioma. Tengo que ayudarles a traducirles. Pero aun así no la compran, no la asimilan, no la entienden, aunque sea para sacarles la idea. Sé que muchos son hispanos.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Más que nada que sus propias compañías la apliquen, porque les va a ayudar demasiado y ya cuando vienen con nosotros, ya tienen la idea, mientras estas compañías no la apliquen, aun así, sean pequeñas, de uno o dos owners. Y que estén empezando. Sí lo aplican van a salir. Adelante y van a tener mejor preparación.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Claro y hasta la fecha.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Cuando sabemos que nos estamos atrasando, hablas a la compañía, vemos que hizo ahora, porque, no porque mandamos a estos porque les urge terminar. Manejamos todo diplomáticamente. Sabes qué tengo este problema, qué busquen la manera de solucionarnos el problema, cómo los ayudamos, pero también pushamos, ya que tenemos fechas límites. Cuando más corto mejor.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Sí tú eres el que me vas a escribir eso cómo foreman o superintendent, sí tú cumples, no va a ver problema, el problema es tienes jefe. Le hablan al dueño de la compañía. Entonces no puedes prevenirlo, pero sí puedes manejarlo. Como lo previenes solamente depende de ti. Si lo cambias, yo te voy a decir por qué.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
No he visto, ni me le he puesto atención cómo mejorarla, pero no he visto alguien que ponga el 100% de atención y se enfoque a eso, porque lo he pensado, pero vagamente. Como mejorar de mantener la gente. es imposible. Debe existir algo, pero ahorita no puedo generalizar cómo. Estaría mintiendo. Lo única qué yo, sí yo fuera el subcontratista, yo le diría a mi patrón, sabes qué manténmelos a mí. quiero terminar, pero ya no depende de mí. y realmente una idea, se me acabarían ahí. Porque he visto los foreman que también trabajan. ¿Qué hago? ¿Para qué? Como le ayudo. En lugar de hacer el trabajo, voy a volver rehacer el trabajo.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Si.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Le ha beneficiado.
27. Do you think the LPS was, or is, effectively carried out on this project?
Se está llevando efectivamente y seguimos, sí detectamos que algo debe haber un cambio, lo haremos para beneficio de nuestra compañía.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Mantener a todo el manpower desde el inicio. ¿Como? ¿Qué necesito hacer? Es una gran pregunta para mí. Es difícil darte una respuesta. No me he puesto a sentar ahí enfrente y ver, ok, esto está bien o no.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Sí hubiera sido, no una desorganización, pero te pondría que todo lo llevamos por escrito antes. No creo ahorita se ha visto más. Para eso son las innovaciones que salen. A comparación de antes, seguíamos al mismo, a nuestra forma de hacer la construcción. Pero sí con esto ha habido muchísimo avance.

Interview #15

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
10 years.
11. What is your understanding of LC culture and practices?
I have a pretty good understanding.
12. What are some of the benefits of implementing LC in projects?
Every single thing we do in projects, make the projects better. Owners and the design and construction team, they all collaborate. For understanding the project feasibility. For putting together, a team that can understand what the owners need. Deliver great quality and safety. Makes design better. To actually release work. Design the budget. We have innovation. We are driving much safer projects, to empower workers to participate in planning. We are preventing overruns in construction, we are speeding to completion up to 20% or reduction resources by 20%.
13. What are some of the challenges of implementing LC in projects?
There is a culture of opacity. There is a difficulty implementing lean. Our contracts drive individually and keep us to work together. Suspicious between owners and contractors, and contractors with subcontractors.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Most people don't have enough time understanding what it is.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
I understand it pretty well.
16. In your experience, what are the main benefits of using the LPS?

In a project, we finished 11 days earlier using the LPS, 30% reduction in resources, who believe that can happen at much higher levels. Every IPD project we are actually what we are able to see has benefits.

17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, it's very easy. We have a one-day training, and by the end of the day, they understand it completely.
19. Typically, do you think subcontractors really buy into the LPS?
Every project that I ever been, all subcontractors bought in. I have never experience that, it's just a matter to make them understand the system.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
You can use simulations so they can understand the idea, like the airplane game, so with that people understand it. People who plan the work. When we get into the phase plan. You tell the strategy for that phase, the stickys on the wall and all the subcontractors go a stand on the wall to put the stickys, then the superintendents go through to make sure it works, it usually takes less time that they were expecting. Then we do the 6 weeks look ahead and the weekly work plan.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Not really, that I remember, they had trouble getting a trade manpower in one project.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
They fired the trade and brought a new one.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Absolutely, because of the stability, if you are the last planner, and have 5 projects, with this tool is very predictable, because you know what you have to do in the future. You know you will be busy. As opposed to unreliable work in other projects where you are not sure you will get paid. The reliable delivery of work makes the LPS the most practical to go in multiple projects. There are many different ways to implement the LPS. you have to have participation from the trades. Is very they are using the LPS in all of their projects. But if they are, that's the kind of company where their crews are actually performing well on the jobs.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
I've never had that issue.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
n/a
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
n/a
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
n/a

Interview #16

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
11. What is your understanding of LC culture and practices?
Probably for the last 6 or 7 years, I've been in projects with components of lean construction. With this company, we do a lot more of lean construction. We don't mandate it as an owner, but we strongly encourage it with our suppliers, as we seen a lot of benefits.
12. What are some of the benefits of implementing LC in projects?
The schedule, they guarantee the schedule. Because of they run the LPS on these boards. Getting the trades up there to coordinate the work in a collaborative mindset helps to ensure the process is going to end on time if not early. Pushing the results to owners. Because in a project with general conditions, the savings here come back to the owner. So that's one and the strong one for us. One of the biggest things is being able to communicate, when is the project going to be finished. Because if we push the dates, we look bad, the GC looks bad, we all look bad. We protect each other.
13. What are some of the challenges of implementing LC in projects?
The lean tools are slow for people to adapt, and to welcome and to actually see value on it. People tend to think the way they have been doing it is the best way. So change is a problem, the reluctance to change from a company or a person has been the biggest thing. How you educate to say, there is a better way. Even to the corporate level. To my boss. What is the benefit of lean to my company? I can explain this, but what is the being the schedule being more stable, what does that mean to a CEO or president, is dollars but is hard, is not a solid metrics, to show. But what they like when the project gets on time and under budget.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
n/a

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
I am familiar. When I say LPS there is a lot of tools.
16. In your experience, what are the main benefits of using the LPS?
I think there are some tools in the LPS that work better than others. For example, pull planning is a one good one. A3 is something we use all the time. CBAs, love to use them, is becoming very well used. CBA is more important for the corporate level. We just an exercise with CBA and it didn't require hardly any explanation from us because it tells the story. That's part of this, tell the document, check the document 10 years from now. The A3 supported by CBA is a big thing. The 5 why's, I am a big fan of it. when we say 5 whys, I've been doing this forever. But if you get them to stop for a moment, to understand what's going on. if you can use all of those tools, yes there is a benefit. In some projects, you may be able to use the pull plan, maybe because of the level of sophistication is not there yet from the GC. You may need to choose.
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?

- n/a
19. Typically, do you think subcontractors really buy into the LPS?
n/a
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
n/a

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
We have towards the tail end of the project, not typically in the beginning. We interview folks for the team, of the project. it's all about the team members. So the GC understand the magnitude of the project. We grade the superintendent, the PM, and that's how they get the job. If they pull him, it would hurt the relationship significantly. If pull him out, he loses the story of the project.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
n/a
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think the lean tools could very well prevent that to happen, because knowing when the tasks are going to be, how long are going to take. It's better guarantee, that your manpower is correct and there are no surprises. It could be the other project affecting because they are not using lean. I think can help to keep the project running correctly.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
n/a

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
n/a
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I don't know that I would change any of the tools. I think have their use or implemented on the project. you got to read your team. How can we use these tools? Because you can overwhelm them. I think the biggest thing is having the proper support from the owner side that wants to use lean tools. Because I believe if the owners buy in, it can help the GC use the lean tools. However, the GC should take it by them and teach the owner. If that happens this could grow to other GCs and owners and everybody would be using lean tools as standard. Have a lean champion to push it within companies. Takes time to convince people, by keep doing it. Change is never easy, but it's inevitable.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

n/a

Interview #17

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
3 in total.
11. What is your understanding of LC culture and practices?
If you are committing when you do your pull plan, the daily schedule, if you stick to it, that is going along with the project is going to help lead the project in the right direction. If you make those commitments in dates, you're saying you're going to meet them and if you don't, that gives the GC a pass way of asking why you didn't meet it, what are the constraints and reasons why you didn't meet them.
12. What are some of the benefits of implementing LC in projects?
If it's done properly yes.
13. What are some of the challenges of implementing LC in projects?
Yes, you are standing here right now, and one of the milestones was supposed to be finished three weeks ago. I told them I needed certain days to finish my job, and in this milestone, it was pretty much done in the bad way, at the last minute. I think the issues are schedule related. If they don't meet those dates, everybody is delayed.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
n/a

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
If it's done properly it works but is like anything else, if one block is not put in the right place or not put at the right time, then the pull plan doesn't work.
16. In your experience, what are the main benefits of using the LPS?
17. In your opinion, what are the main challenges of implementing the LPS?
18. In your experience, do you think the LPS is complicated?
It's not complicated, you just got to think about what you're committed. To make sure you have enough manpower to meet those commitments.
19. Typically, do you think subcontractors really buy into the LPS?
Some of them yes, and some don't. Some just say they will do it and some don't. If one subcontractor takes more than the necessary time, that will push the rest of the other contractors to do their work. I think there are some contractors that will not buy it. Some of them will buy it as long as it is done properly.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
If you can sit down with the people and really get them to buy it into explaining to them how it will benefit to them, because there are still contractors out there that are old school, they don't accept it very easily. You may need to explain it several times, so they get it in their head, and say this can help me manpower, this can save me money. Everything goes back to money. So if you can put it into their head and it's done properly and they can save money on it, then they will buy into it.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
First of all, 9 times out of 10, you find about it until the crews don't show up. But if you get notified before you can work around it. But when I don't show up, you don't have any idea why they didn't show up. You get frustrated, you make phone calls to find out what's going on. We can actually handle it. But if it's something we can't do, it goes above me to my office, I get higher bosses to call.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I don't think you can prevent that situation, even if you have your whole plan and no one showed up. If they left for the day, and you make phone calls, you won't find a way to do something until the next morning. I don't see where the lean plan can prevent it. That's because it's like, let's say for this activity if we all are set up for the activity, and that people have a bigger activity somewhere else, I don't see how it can prevent it to happen.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
n/a

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Not yet.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Affected the project. we didn't hit that milestone.
27. Do you think the LPS was, or is, effectively carried out on this project?
I don't think it was 100% right, because if you to the board, you push the plan in the plan, so everybody looks at it. Then the next one goes and misses a commitment. In this project, we didn't hit that important milestone, so I lost time and had to bring more people to get this activity ready as when needed.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Old people to walk to the boards. If you go in on weekly meetings and we talk about our commitments for the next 6 weeks out, this was all commitments. This activity was delayed you can notice that.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Complete chaos, because you will have somewhere on the line, you will have a sub mad against another sub and they will do whatever they can to not being ready for them to do the work. That's the reason why lean was implemented because the old ways didn't work anymore, that's how the lean process started to bring this effects. You see the changes over the years and you will see this. Lean eliminates waste.

Interview #18

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
4 projects in total.
11. What is your understanding of LC culture and practices?
Is a process that when used effectively, makes the project more efficient. Both from the scheduling perspective as well as from the cost efficiencies.
12. What are some of the benefits of implementing LC in projects?
Using the numerous lean processes, we have seen benefits including decreased wasted in labor and materials. I can give you some examples. The pull planning process and its subsequent development into the look ahead schedules offer more opportunities to plan material procurement. So the material is delivered when is needed and we are not scrambling at the last minute to receive materials. From the labor standpoint, it allows the subcontractors to identify track and assess the manpower they have on the job, to assure the productivity planned in the schedule is actually achieved.
13. What are some of the challenges of implementing LC in projects?
The buy-in and participation from all subcontractors. Lean techniques are different from what has been used in the past. We are seeing the effects of not having the right person now from the contractors coming in and doing the pull plans and look ahead schedules in the boards, not having the right person with the right attitude, that does not allow the right effect of the lean processes.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
With anything new, you are going to have some initial resistance. The mentality that you've heard in the past is why should I do something different if this works. You have that when implementing lean in projects for the first time. With people not exposed to lean.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
You wrap up all these lean practices and that's the name that's been given for pretty much the overall process. about these individual tools. The pull planning, the look ahead, and the visual tools that we have. All of these incorporate that. Including the 6S. The last planner is basically putting a name to that system.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
It is a relatively new system, but it's founded upon, techniques that some of the tradesmen have been doing for a while. Either they realize it or not. It involves those foremen that have the information for the stickys. It involves them in the schedules. They already know if, they know the productivity. However, the LPS has encouraged them to take that out of their minds and put it in a paper, so in a collaboratively way everybody can see it. So depending on the way you implement it. If it's not roll out properly, then I can see how challenging it can be. However, if you do roll out the tool smoothly and properly, it can convince individuals who don't like change.
19. Typically, do you think subcontractors really buy into the LPS?
The true limit test for a contractor to go all in on a project, we can get that. But they don't truly understand whether it works or not, until they finish a full job, that they have been able to start and finish and keep track on what they thought it would cost in materials and labor, vs what it really costs, so they can kind of compare. So hopefully there are some savings in both. So they attribute that to the LPS.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
n/a

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes, that is a common issue in our industry.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
You would have to make sure on your project, that you stay on top of their manpower. Their productivity. To make sure they are keeping up with their schedule and notify them if there is any slippage in productivity. But you are reacting to what you see instead of planning ahead. But knowing ahead of time your manpower that is needed to have enough productivity, with the LPS you can track that on a daily basis.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
We are at the point now to understand the full LPS. We are trying to make sure things are done right. Some of the tools that currently exists in the LPS, that would avoid that issue to happen? I think is start with pull planning, to understand the sequence of events that need to happen for us to hit a milestone and then combining it with a schedule, so put it in a 6 weeks look ahead. So this way we know how long it would take and how much money. This way production increases. We can see the number of bodies in the jobsite and their production rate.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
I don't know if to use the actual system, vs who is filling up the stickys, as well as looking over what is posted on the wall, because if someone understand production rates and they may not, and they may be overstating the production, and then the supervisor from the GC looking at that, and doesn't know if something smells bad, that may be a vulnerable opportunity in the system. But is not the system is overseeing who is using the tools.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No, but we had obstacles that prevent us to do the cycles. We have some strict constraints in the project. We are limited due to the project location, and the amount of formwork that we have. We have to keep it longer, due to the project needs.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Benefited.
27. Do you think the LPS was, or is, effectively carried out on this project?
Improving
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
The sooner the better. I can give you an example. A lot of the LPS early on in the job, the design team was already under design, they were not finished but we could involve them early on. I see the opportunity to implement it earlier to the design team. Because I've seen the LPS rolled out in a design-build project and that was the very first one they did, very early on, we had a good facilitator. The facilitator was able to convince the designers that was something good for the project. So it was very valuable in that project because you can get a lot of their time out of their schedule. They can get the design as quick as they can.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

If we had not implemented the LPS, we would not have had the same work on place at this moment. As it forces collaboration within trades. They take it from the pull plan to the actual work on place. Each of the subcontractors that have participated in this project are better planners than they were before they started this project with the lean practices.

Interview #19

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Yes, in 3.
11. What is your understanding of LC culture and practices?
If it's done correctly is good. It's about making sure that all schedule comes in, and making sure the materials arrive on time and don't waste space. You avoid material sitting there for a long time.
12. What are some of the benefits of implementing LC in projects?
Pretty much having all material here on time for being installed. And making sure that everything is installed according to the schedule.
13. What are some of the challenges of implementing LC in projects?
Beings things like unforeseen situations. That you can't anticipate. Or also that you can't keep the material flowing to the jobsite. That's the hard part in running lean, because you don't have the extra material on site. If there is a change, it takes you more time to do it.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
You have to have everybody on board. If all your subs and GCs are on board will go fine, otherwise, you can't run well the lean project.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Pull planning is pretty much going on your future look. Going into your 2 or 3-week schedule. Planning your work into several weeks ahead. We do on a weekly basis this, to plan for the future.
16. In your experience, what are the main benefits of using the LPS?
Yes, you can order the material. You know when the project needs it. You know if you can expect any kind of delays. You know coordination with other trades. But if you don't have RFIs or submittals that need to be approved, and constraints you won't see the benefits.
17. In your opinion, what are the main challenges of implementing the LPS?
Trying to go out a little bit further. Making sure instead of doing one week try to do 2 weeks. To say if you can't do what you said, maybe you can do another thing the next day to catch up. If GC can say hey push your schedule out for two weeks. You do it 3 weeks ahead but it's just targets. So if you can break down what you will be doing for the next 2 weeks, I think it would be a lot better.
18. In your experience, do you think the LPS is complicated?
For a beginner yes. Because people are construction workers, that's why we are here. so a lot of more train will make it better. And then when we start with the superintendents they'll do it. But when you ask the people, that's when the issue comes.
19. Typically, do you think subcontractors really buy into the LPS?
Honestly, you will have to buy it if you don't do it you don't want to make money for your company. You want to benefit yourself so you benefit the company. Other people, I can't answer that.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
n/a

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes, but we don't know what the manpower it's in their situation. But if you have the person knows what's going on the site, they can say I don't have the manpower.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
I'll tell him, you have to bring another machine or manpower. Push them.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
You are always going to have the subcontractor saying a got a group of guys that I need to take out. You can't control it. Or even a machine broke. You can't control that. So the LC or LPS won't prevent that to happen.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
There is a lot of things that you can change. But I think if you are not using an equipment it will cost you money, so it is difficult to say.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Yes, it has improved. Because I can see the schedule and what is going on. But the rest of the trades, I don't think so.
27. Do you think the LPS was, or is, effectively carried out on this project?
In this project the trade participation is low. Probably they need to push the PPC to 70%. It could be improved but you need more participation.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
n/a
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Not meet the schedule. I guess you wouldn't know when the other trades would make their activities in a confident way. It has good benefits for this project.

Interview #20

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
4 projects in total.
11. What is your understanding of LC culture and practices?
It offers the solution to eliminating waste in the construction industry. Waste is defined in terms of materials, time, just any inefficiencies in the way we do things. It also offers the solution to empower employees. To make decisions faster and to build trust among the employees in the project team. To deliver a project in a hall of efficiency.

12. What are some of the benefits of implementing LC in projects?
As I mentioned. I think lean helps a project team to build trust because when you start collaborating as much as you do, with lean construction, then, the project team states trusting and commitments that other team members can make. It helps for members of the projects team, subcontractor projects, management design team. Members to look at themselves outside, what is typical for them on a project. knowing that this method of doing construction is pushing the limits on everything. Hey, this is our shortcoming. It also helps to eliminate waste and redundancy.
13. What are some of the challenges of implementing LC in projects?
People as with anything is a reluctance to change. People generally is reluctant to new ideas. Then there are some GCs who try to adapt lean and are not committed to the process and they make certain things in probably not the best way. Although lean is a process of continual improvement. They do things in a way that probably I would say traditionally, because some contractors may have a bad experience. They think lean is bad.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Usually, it's a little more toxic on time, because the members of the team, will have to come and spend some time every morning discussing the plan. The project teams who are not used to that if they are planning in the morning the day, they will get done more on the day.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
It's one of the ways they do lean construction. The LPS you start with the last task that you are required to close out the project and then go back by saying ok what is it this person needs to complete this last task. And you continue tracking until you get the staff of the project.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
For some of the subs is a little over their heads. Having a background in construction and having scheduling classes I don't it's complicated to me. But I think some of the subs that I have seen they get lost in this process.
19. Typically, do you think subcontractors really buy into the LPS?
A growing attraction to lean construction with subcontractors. Generally speaking, I would say the most favorable to not that I have seen previously. There have been growing a number of subs who started implement lean in their own. That is very good.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Usually, the trades who are really not deep into lean, because they don't see the results of it. by quantifying the performance. By telling them you promised to do it by Monday, and you did it that day. Just making them aware that meeting their commitments in some way that is quantifiable and showing it to them, so they can compare to other trades on the site. That is very valuable to them.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
That is very popular.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?

The problem is usually GCs would approach that situation in 2 ways. The GC will contact the trade and tell them why they bid the project because they had no enough manpower. They tend to not tell you they have a problem somewhere else until it is too late. And there you can't really help them because you messed them the schedule. But if you came this week saying we can't commit this week with the same manpower, now you can plan for the problem. Because now you can plan for it. Otherwise, then they don't fulfill the commitment you will have a problem. Traditionally you would approach them, telling them their results and commitments, why you didn't meet the commitment? It seems you didn't do it because you planned to have a full crew, and you didn't, now tell us what you are going to do.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

I think it's more of a trust issue. If the trade trust that you are seeking them. Then they will be as a company, you are not seeking your best interest in this project, then they will be coming to tell you, hey I have a little project, this is the situation, and will affect my performance here. they would be more willing to do something like that if they trust you. Building trust with them, the more you communicate with them. Eventually, guys build comradery and they get to that point of trust to tell you that. I see the problem of lean when they don't fulfill their commitments because they have a fire somewhere else. Usually is not the guys on the field making that call, so the office guys are the ones making the problem. So the field guys usually don't know about it. there isn't a tool that prevents that from happening, it's just there is more communication with the office and the field.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

It may be a very good tool to every week, whatever obligation has made by the guys in the field it's distributed to the guys in the office and say look at the guys on the field commitment and confirm it.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?

n/a

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?

n/a

27. Do you think the LPS was, or is, effectively carried out on this project?

n/a

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

Communication, it's a tool that's valuable for making promises and commitments and obligations, but unless you're communicating the results back to the trades and say, hey this is what you committed to, and this is what is actually done. These are the reasons why you didn't make it. What happened? The weather, unless we assure and performance, I think it's not going to be valuable to the subs. If you do that, subs will see the benefits. Money is the bottom line.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

n/a

Interview #21

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?

This is my first time.

11. What is your understanding of LC culture and practices?
Ensure that all the other trades are there. Not only knowing your work but also ensuring that everybody is doing what they are supposed to be doing. Per the schedule but at the same time, in a safe manner.
12. What are some of the benefits of implementing LC in projects?
Prior to an activity from other trade, I was able to know when they were going to start, dates, areas, for me to know is important so I can have the material and manpower ready.
13. What are some of the challenges of implementing LC in projects?
When we have constraints, like waiting on answers come through the customer, because the changes the customer makes, but they are not really sure on what they really want, so it's good to have that system in my opinion.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
It was really hard to get used to the system. Because you are not used to going in every day with all the other trades and talk about what needs to be done. Once you get used to it, becomes easier. If day you participate.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
16. In your experience, what are the main benefits of using the LPS?
17. In your opinion, what are the main challenges of implementing the LPS?
18. In your experience, do you think the LPS is complicated?
At first, it is. For me, it was really easy to use the second or third day I was there. Other trades may have a little difficult getting a hand on it. After having a talk with them it all makes sense to them. It helps me and helps them out.
19. Typically, do you think subcontractors really buy into the LPS?
It's very hard to say because everybody works a little different. I think it's a little though on other contractors first. But over time it kind, it is a little difficult to other contractors. It depends on how they grasp it.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I will have to think about that one.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
No.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
n/a
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Every now and then, I lose a guy. All of our guys go to training programs. Sometimes when I have two guys out its only for one day. But the lean system, in the mornings I just tell them I'm short of manpower. I don't think lean can prevent that from happening.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
No, sometimes they got to go so school.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
A little bit of both. It benefited as far as coordination with other trades.
27. Do you think the LPS was, or is, effectively carried out on this project?
Improving, it affected the amount of time spent in those meetings. Because you have to be in the morning in the meetings. If you are working in another activity, you have to stop and go to the meeting. But if you are in the middle of something important and you can't go to the meeting. It kind of affects the whole day. I feel it should be done, not every day, but either at the beginning of the week and at the end of the week. Or if you go every day, make it 10 or 15min, because if I'm working on something it's hard for me to sit 30 minutes and explain in detail exactly what's being done on that day. We already discussed it the day before. Have a more effective meeting.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Reduce daily huddles to 10 to 15 min.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
It may be a little bit of consequences to a certain point. Because nobody would know, the only communication we would have is. In my position I have to deal not only with one trade, I have to deal with different trades, which in a traditional installation without the lean project that's the way I've done projects, without it is by me communicating directly to trades. Which is similar to what we do in the meetings, but in the meetings is easier, because I don't have to chase the trades. The lean system does really help.

Interview #22

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
No this is my first project.
11. What is your understanding of LC culture and practices?
It's just to help you to plan the job better, with the daily updates and meetings where everybody is at. You can update where you are and everyone else.
12. What are some of the benefits of implementing LC in projects?
You get everyone together, where you can talk about any problems that you may have. Just coordination issues.
13. What are some of the challenges of implementing LC in projects?
Making it to the meeting every day, sometimes you are busy trying to do other stuff. But the meetings don't take long, the weekly meeting is a long one, the other days is just 5 to 10 minutes. But anywhere I am I have to be there.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Not really, I didn't understand what was going on, I didn't know what it was, but I wasn't sure if they were going to give me a regular schedule or how the boards work. We didn't get an initial training.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No
19. Typically, do you think subcontractors really buy into the LPS?
Yes
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Not right now.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Most recently, it did affect my project here. What I ended up doing is moving a lot of people to meet a deadline. When we finished we just tried to put more people back. Maybe work a couple days extra, until we recovered the delay.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I can see the potential that it could help to alleviate problems, but normally If you have a fire, it's usually from poor planning anyway, not necessarily a scheduling issue, the schedule is always there and it's usually somebody else's fault not planning properly, putting enough man there. I'm not sure. The lean system as long as you follow it and meet your deadlines that you put on the board, the yeah that would help you. Other than that I don't see how. Is not much different from other situations, other jobs that I ever been in, every week they give you a schedule.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Not really.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I think it's beneficial. It makes it easier to see where everybody is at. When they put it there, they tell me where they are, a couple of days before I can plan to have the material on site to do it. But it's the same if I have a paper schedule, I can do the same with that.
27. Do you think the LPS was, or is, effectively carried out on this project?
Yes, since I have nothing to compare to.

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I would like some sort of paper, they do give me one, but I don't get it every week. The board pictures I get are not enough.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Maybe a little less organized. It's hard to say, I haven't really had too many big problems on other projects without this system. It depends on the individual's and how they work together. Regardless of the lean system or the traditional way.

Interview #23

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
2 in total.
11. What is your understanding of LC culture and practices?
Lean is planning ahead and you know what the schedule is, what you have to do accordingly.
12. What are some of the benefits of implementing LC in projects?
I don't see too many because a lot of times it doesn't go through the lean program.
13. What are some of the challenges of implementing LC in projects?
Trying to get the lean program to the work, but I tell you that the contractor is the one with the expertise, is kind of hard try to work with that when you are at the construction site, and another subcontractor doesn't believe in lean, so is difficult. Not everyone buys into the system.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
n/a

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
We don't care for it, because it never goes according to it and a lot of times is more push for thinking, because you never know what's going to happen, for example, right here, this big activity, they haven't finished, they had their stickys and plan and all that goes out of the window.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
Is not complicated, is easy, but it's a waste of time.
19. Typically, do you think subcontractors really buy into the LPS?
I don't think so.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Subcontractors need to bring people who are the ones who actually are going to do in their work, more involvement, not just the PM, the superintendent, and you need to inform that. If they know what they got and how to go. If they are sitting in the office, they are not here.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

- Yes.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
n/a
 23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Yes, it can, but like I said as long as you got the right people involved. Pull planning can work, but it needs to be improved. At this moment it doesn't prevent it. They involve the higher level people, engineers, project manager, but they don't involve the people actually doing the work.
 24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
no
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
So far I think it has worked ok, we are meeting this goal of the pull planning schedule, but the subcontractors are understanding it, and have to act accordingly. Again, the lean is a super good tool, everybody is on top of everything, they got to do, it's not just all the way they plan it.
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
n/a
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
It would be more communicative between the trades, you know, how long it will take you for this activity, or when are you going to do it? We would know ahead things, we need to concentrate on this area. But if you got this pull plan, they got to get this tomorrow, but today, but we are not ready, with all that stuff, communication will be difficult. And that will be fine, everybody communicating with each other, of course, this pull planning stuff gives you an idea of what they propose, but is that what they will be done? Without it, I think we would be fine.

Interview #24

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my first full lean project, in previous projects we used parts of lean. We focused everything on some tools. For instance, we used pull plan, but we didn't use weekly work plans. Just to try to improve flow on the project on our weekly and daily basis. So we didn't get the full fruits and flavors that we could have seen if we use the full system. And I knew that but it's hard to commit your superintendent sometimes, how important is this.
11. What is your understanding of LC culture and practices?
I know about how to put LC in place on this project, as we launched this project, being in a new project and having an initiative on this company to go the direction of Lean, we wanted to approach this project in the leanest way possible, using all tools. I have a lot of training internally and have asked questions of my peers who have used it, I have implemented some lean tools in my previous projects, but we haven't implemented 100% of the tools, only pieces of it. So it was also very good

to use the whole system and see if you use the whole system vs checking the system and choosing which tools to use on the project.

12. What are some of the benefits of implementing LC in projects?
the benefits are how to get to your milestone date that you're striving for because everything is up there, everybody is commonsense to one another. You can't move forward, but all these people in the room are trying to think how to solve the issue. You can't move forward. And then someone says what if we move the sticky note from here to here and do it at the same time of that. Then it creates days that we didn't have. We wouldn't be able to do that if that wasn't on a sheet of paper on the wall and all those great minds thinking about that. That's the benefit I see, collaborate with your team. If you do that, then you'll think outside of the box even greater, because you did it once and you did it with this people. The other benefit is I think it helps the team to work together better. I think It just fosters the spirit of collaboration.
13. What are some of the challenges of implementing LC in projects?
The challenges of lean are just to get buy-in. Because what I've witnessed is that people got to have their ah-ha moment, so they can see this can work, and make things more efficient. To achieve a quicker completion date, some milestone. They got to score have their ah-ha moment on their own. You can lead them and repeatedly with water, but at some point, they have to drink it by themselves. When they do that, I haven't seen anyone who is gotten an ah-ha moment, and they turned and decided they didn't like lean. Then they try to implement to word to everybody else. I had my own moments like that. Where things really came together and I think it was great.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
With lean onboard training, you can enhance that initial process. With the training you talk about the tools that we are going to use for lean on the project and play a game to get them involved in the process and at the very first meeting for the project, they are learning how to do the pull planning they'll do later.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
On this project, we handled the LPS. This is part of our lean culture. Including the 5s, all of the other keywords that we programmed with lean, the LPS is part of our culture on this job.
16. In your experience, what are the main benefits of using the LPS?
I think you could just do the LPS and have a better product than you could if you didn't use it at all. Even if you didn't use 5s.
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
It is complicated, you need to have some people that have done it before. I think you need a coach or a peer that can help leading your team, and who provides the insight of how has worked for them in their ah-ha moments, so you can get the buy-in that you're going to need from everybody else. If you just got one guy trying making happen, some of them just don't have enough push to make 20 subs to make them on board. But if you have a coach and a couple of subs that have done it before, if you let them help you, it will work that way.
19. Typically, do you think subcontractors really buy into the LPS?
No, I don't they do. Not at the beginning, there is a lot of people that don't go along it, and they think it's really not good. They have to do it because its contractually required it. It says we are going to do it and you need to participate. Because we need them to get buy into the system. But I think that somewhere along the way they have their ah-ha moment and that's when they buy in. they participate more and they really put their stickys on the wall in a way that is meaningful to all the other trades find helpful, and making sure that I put everything on the table. So I can get commitments of everybody else and I can complete my commitments as well.

20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?

I think that we have put on place something that has improved the LPS. Which is rolling it out when the subs start on the project, telling them this is what we are doing and this is how we are doing it and why we are doing it. So it's kind of a testimonial and we played the game, and that kind of figures it out, and helps them understand why we are doing the LPS, with the elementary version of the system with the game. And when they see it usually they buy it. With these meetings we are combining them with the precon meetings, so from 33 meetings that we were planning for lean, now we have only 6 meetings that we are planning to do with several subs at the same time and they begin to learn how to do the generic things on projects and they learn about lean and what's to come. And when they come to their first pull plan, they have more knowledge about it, they don't come totally blind. Even to the point that we only need to send a document before the pull plan that says this is what we are pull planning up to this milestone, these are the constraints, so you can get prepared before the meeting, and think about how they would do it. Once we get on the wall our goal is to shake that schedule and make sure the stickys on the wall are really the best way to do it. This lean onboarding training is key for key and contractors.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

I've experienced them.

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?

We remind them that we sat down to review the scope of work, we asked questions to make sure they are not overextended, so they can handle this job on the timeframe we need them. We talked about the schedule, logistics, how many people they may put to meet the milestone. Ask them about subcontractors, and their employees? Or are they hiring someone else? We want to know if they really have the people of not. And we protect our risks by asking those questions. And we ask them at the time, before signing the contract. If they want it, they would be thoughtful in their answers and they would make commitments to us that would lead us to this. And then we just remind them about that if that issue comes. That's not what you said you have to rearrange it. Sometimes you can be flexible. With the LPS you are touching 6 weeks out and subcontractors' meetings on weekly basis and daily huddles talking about what you're going to do every day. It shouldn't happen in the period of analysis, but what may happen is when you're going to start the next activity and they are finishing another job. And they may bring smaller crews. That would be something that we would be able to work through. There are some much conversations happening. If we need to have some letters we issue them.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

I think that those subs get more than they can get. But the squeaky wheel can get the people. So the job with the LPS implemented is the job that will get the people on it. Because other reinforcement you did early on will help. The LPS by definition is the system that continuously reinforces what the needs are. Then the subcontractors are more apt to actually fulfill the requirements.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

I think that talking to them in the prebid conferences, we can't tell them what crew they need to put that scope of work on place. They have to tell us that part, we can't dictate it to that, we don't know the trade for one thing. But we can tell them the time frame and then reiterate at those prebid conferences, they get in the bid manual, the first thing we talk about is they review the scope. So it's a just a matter of reinforcing those dates, every time we do it. After we have the contract we talk about during the pull plan we implement. I think it's just about reinforcing for days. And to

know for the project team, what their dates are, you got to look at their schedules and they'll tell you the window that you can tell your subcontractor. And we may have it wrong, we have 12 weeks for something that may take us 6. We may be wrong. That's why we ask them for their guidance on durations. One way to improve it would be to put a sheet or paper or on the sticky, the crew size that you need when it's needed, that way you can get out there and check and identify. But that may be putting too much process, and not letting the process work, because the process is driven by duration and then apply people to hit the duration that they have. So as soon as you have to put more people, in order to get it completed in a smaller timeframe, that may actually do the reverse. If you dictate too much and don't let them freely think on how to solve the problem. It could be implemented in the weekly work planning or the pull planning. Should be in pull planning and then just reinforce it in all the pieces of the LPS. You reinforce it in the WWP and in the daily huddles. You check to make sure you have that number of crew. And if you see a problem on day 2, with fewer people than agreed, that's a pattern, so they would have to solve it. That's what PPC is, what if you've done your plan that's accurate either faster or slower, you want to hit it. So if you miss it, you measure that. If you're not getting the work on place, there is probably a reason that maybe the crew size that you saw using the LPS and the PPC, to determine if that happened. Because you measure it daily.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
N/A
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I don't know that we are going to see a major difference on end dates, but we may be able to bring things a little sooner. We are going to have some pull planning sessions in which we may see that. But we are going to deliver the project on time.
27. Do you think the LPS was, or is, effectively carried out on this project?
I think we are learning and improving.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
It's kind of difficult to explain the ah-ha moments to people, you have to watch it. Eventually over time we'll get these things on tape when these awesome things happen.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I have a perfect example. The overwhelming question if wouldn't have the LPS, to try to determine how we would finish this phase on the milestone. We had weather issues. We got everybody on board, to solve the issue. So someone had an idea to leave part of the job for later and continue with some other activity. So that activity was delaying the rest of the job, so we moved the sequence. So the resequencing of that activity was the best benefit of using on this project. That was sort of an ah-ha moment. So we moved it and visually we made magic on the project.

Interview #25

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
5 years of projects.
11. What is your understanding of LC culture and practices?
They are related to how you do most efficiently do things in a manner a single time, as much as possible. Is very simple. How to be able to also describe to all parties involved what the plan is and

- how you are targeting it. So you have a consistent basis of information and everybody involved and you don't repeat.
12. What are some of the benefits of implementing LC in projects?
Better quality on the job. You tend to have a better performance and efficiency with repetitive work. So you lower your manpower and time for the project. Any time that will help you to improve safety in the project.
 13. What are some of the challenges of implementing LC in projects?
Cultural. Because nature being the GC says what to do. We have to play with different cultures in the trades, to have them on board. As well as personalities. It is an educational process and depends on what everybody is on their journey and how respectful are the lean practices. And the individual trades say how to apply it and how to achieve the goals.
 14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Cultural issues.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
They are inseparable. The magic of the LPS is the engagement of the very lowest possible foreman level to create accountability to manage the place. You also use them to create the schedule. So the idea of the pull planning, and the analysis are written on a table. And it's easier to move it in a pusher or a puller. So it's a cultural practice of understanding that process. everybody makes promises about what to do. Then you use the PPC system to track those promises.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, it is not a complicated system. It's the cultural mind shift if you have been in the industry for more than 10 years is a different way to see this. Some of the tools we have been using them before. All the terminology comes from the industry. But they are pretty similar to what we used.
19. Typically, do you think subcontractors really buy into the LPS?
Once they understand the benefits, like anybody else, if I can make more money, they will adopt it more quickly. Buy it takes to being modeled and being consistently being required until you get to that point.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
One element is a simple contractual requirement. Once this happens, they have to do it, but you have to be able to train them. So you train them so they the opportunity to learn.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Sure, you can't prevent that experience. Resource leveling by subcontractors impacts our job, the question is what the impact of that issue. And what ability you have to not let that to happen. But you are not going to avoid it.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
There are two ways. The first way is you start with ok, what is the issue that have and what is your schedule. Depending upon on what your ability is to observe you then become directional and use contractual tools to ask them to push the issue, by setting standards, which is the least friendly way

to accomplish. Or you simply get their buy in and make your job easier, to take place. Profitably jobs, you remind them, here is where you making money. Leaving here is not going to make you more money.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

No, it doesn't prevent the issue. What if would typically do, is make a case of awareness of the issue. And the trade work on it earlier. And the reason is the trade contractors would allow their lower level to direct managers into the meeting to say here is what they can do. Making promises that you typically get from senior management to lower or middle-level promises. So it's a more accurate way to do it. You have an early awareness of what the real problems are.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

The LPS in our industry is something that we are very visual. So the more visual it is, the less leaking you experience at the bottom line, and that takes a series of successes. So it's having a way to maintain the metrics, the LPS job will have this kind of marking and on. You know, not LPS job has this margin. Until you have that kind of data to establish a metric, it's going to be hard to track.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?

n/a

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?

Benefited. We would see the benefits as the projects get into a higher production set. Because you set the stage to that production cycle. Then you are able to capture the efficiencies of the planning process.

27. Do you think the LPS was, or is, effectively carried out on this project?

The LPS here, just like in any project. when we started this project there were few people with the LPS training, so it is an educational culture of thinking. We used to have problems with attendance to the daily huddle, now its automatically. So it's a cultural change.

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

Earlier team training. Before actually on site start.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

It would be a more hardship environment, contingencies. Hey, this is the deal, you have to meet this date, understanding what it takes to take this date. Not just arbitrary dates. You also create unnecessary tension with your client relationships. Because we also try to meet their requirements. More tense staff. Document more things for future issues than solving problems for the moment.

Interview #26

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?

This is my first project.

11. What is your understanding of LC culture and practices?

More of a way to get everybody participating in the same plan for the day of the work. Safer and being aware we are going to work.

12. What are some of the benefits of implementing LC in projects?

Getting everybody huddle together, everybody alerts of what's going around.

13. What are some of the challenges of implementing LC in projects?
I don't think of any big challenges that I've seen. Maybe like the physical way other than just showing it just on a board. I've been to their jobs, where the GC provides little mini iPad or laptops, they give it to us. They let us meet in the morning and plan the day. Visually, because most people don't know the board. Many people don't speak Spanish.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Since we started we had only a few guys. So that wasn't a big deal because we were not a lot.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
This is my first project.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No. But it could be complicated to other people, due to the language barrier.
19. Typically, do you think subcontractors really buy into the LPS?
I think they do.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Just that visual thing.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yeah, actually I had a project where I was in. We had that issue, they went to another job.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
We work around that issue. We just talk to their superintendent. And they need to bring back the people that are needed. Guys from another job.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
No, I don't it prevents that to happen.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Depends on the sub supervisor, how busy he is now. Manpower is up to them. How to control it? scheduling.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I think it benefited it. as far as everybody being where they supposed to be. It is good for being on time, on schedule. Being safe.

27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Just adding the visuals.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
The trades would be not as spoke as it is right know. I know practices for each trade is different, but it provides it for everybody. Letting them know what they are doing, what's wrong here, everybody is more alert. The project feels friendlier between the trades.

Interview #27

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my first one.
11. What is your understanding of LC culture and practices?
The methodology is very good; they have a lot of great tools. I'm more used to six sigma, which is pretty much almost the same thing, branded a little bit different. All the concepts in lean are in six sigma. I'm not sure if you can use all of them in the industry. Maybe it can be done. The best thing is the communication. Having everybody on the same page.
12. What are some of the benefits of implementing LC in projects?
Getting everybody to talk, which is difficult. It depends on the facilitation of it. You can have all of the great programs in the world, but if it's not facilitated correctly it's just going to be confusing. I think the purpose of lean it's not just check the box. You can be over engineering something, you can over lean something.
13. What are some of the challenges of implementing LC in projects?
Too many meetings. There are some that have to be done. I'm not sure if adding more will help. You have to be present at all the time.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
The implementation is fine. However, preinfo of meetings should be provided so everybody goes prepared for the meeting.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
I'm not very related, but I'm related to pull planning. It's easier to go pull vs push flow. You get the task done. It's a great concept that you start at the end and then you pull it out.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
Sometimes.
19. Typically, do you think subcontractors really buy into the LPS?
Superintendents, I don't think so, but PM yes. PM do you into it, it's just converting the superintendents to do it. If they can present it in a different way, I think that would help them understand it
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I think three weeks for them it's a little too long. I think one week would be enough for planning.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
I've seen it in the past. The idea is the same, hurry them and wait. You can find other ways to be productive at the same time, but you really can't find an efficient way to do it.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
There is always room to improve as far as being understaffed and underperforming. The best still is communication. Is knowing before exactly that day if there is going to be an issue to plan for. There needs to be a daily plan also and a percentage complete at the end of the day. Knowing the next day what everybody will do is helpful. Planning the catch up on activities in your look ahead planning, within the schedule can help you to do it. Don't just throw people at a job and not productively have people just waiting for materials or work.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
no
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
It's a great learning process. I think the whole company should use the standard procedures, and I think that should happen here. so the tracking of that is very important. I like it, maybe don't agree with everything, but it's a great learning opportunity.
27. Do you think the LPS was, or is, effectively carried out on this project?
I think it's on the right track.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Just a little bit more structured. We are trying to follow some type of assessment. We need to stick to the plan, versus go with our own idea of lean and assess it. You have to follow the program in the way it was created.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
You could miss something. You may have people working in their own little bubble thinking everything is ok. Once you have a plan you have to stick to the plan. Stick to the method. Try it, test it. You just keep doing the same thing.

Interview #28

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Este es mi tercero.
11. What is your understanding of LC culture and practices?

- Figurear el día, o la semana, qué es lo que se tiene que hacer y qué es lo que se tiene que planear.
12. What are some of the benefits of implementing LC in projects?
Ninguno.
 13. What are some of the challenges of implementing LC in projects?
Todos los días. Todo está bien, pero ciertas personas no cumplen con esto. Para mí esto no vale nada, no funciona. Funcionaria si las otras personas cumplieran. A mí me tiene que dar trabajos otros trades, pero yo primero les tengo que dar trabajo a los otros. Ellos no me acaban, para mí no me sirve. Porque no se comprometen.
 14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Aquí yo ya no apunto nada. Ellos apuntan. Yo les dije tu dime que quieres y ponle ahí y yo acabo ese día. Pero sí a mí me atrasan ya no es mi problema. Se les dice a todos, que días puedes acabar y todos dice no, en tres días, y al cuarto entro yo, si no acabas, yo me atraso. Es el problema, los demás no cumplen.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Yo ya tenía conocimiento de esto.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No es complicado. Al menos yo, apunto en mi cuaderno cuantas personas traigo. Si me dicen necesito dos personas en esta área, o hago y así. Yo planeo lo mío, mas no sé si se hace por las demás personas que no cumplen. Por decir este trade pone dos personas, pero él no trae toda la gente. No es lo mismo estar trabajando en esta pared y a terminarla y venir y trabajar aquí y mover para trabajar. Para decir hice poquito aquí y allá. Así no trabajo. Debes terminar áreas, porque vienen otra persona. Está en las compañías. Y así no funciona esto. Si funciona es tal día me tienes que acabar y así. Yo hay veces que vengo y si no acaban, ya me atrasaron. Todo es un proceso. Todos debemos de trabajar en conjunto y con comunicación. Eso no está funcionando.
19. Typically, do you think subcontractors really buy into the LPS?
A mí se me hace que no. Para mí es Buena idea, siempre y cuando los demás cumplan.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
A mí se me hace que está bien. Para empezar esto está bien, siempre y cuando las compañías cumplan. Porque uno apunta el día, ellos no nos lo dan. A mí me dicen, en esta semana esto es lo que busquen, en cuantos días me lo tienes para que entre el otro. No pos 3 días, ok uno le pone ahí 3 días y tantas personas. Entonces, se supone que ese día, tienes que acabar. Es cuestión de los superintendentes. Es simple, es cuestión de responsabilidad. Si pongo que tengo que acabar en una semana, tengo que tener material y la gente. Pero si nomas le pongo para que el superintendente este contento, con cumple.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Nosotros contratamos gente. Si necesito más gente y no hay en la compañía, subcontratan a otra compañía. Hay veces que me los quitan antes de lo necesario y ahí me atraso.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?

Hablando con la gente. Yo sé qué nos va a tocar apurarnos más y sacar el trabajo. Horas extras solo cuando ellos lo pidan y autoricen.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

No, eso es aparte. En mi situación está fuera de control.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

Eso no está en cuestión de uno. Eso es cuestión de qué si se hace un contrato se debe respetar.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?

No. Bueno ahorita me dijeron qué quieren más gente, porque yo espere mucho tiempo, traía 30 personas, los demás solo con 5 o 10. Ya acabé todo, ahora quieren que yo acabe, porque ellos no se apuraron. Y a última hora quieren qué yo acabe.

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?

Ni le beneficia, ni le perjudica. Pero para mí está bien. Porque simplemente. No me perjudica porque siempre trato de ir Adelante de todo. Me beneficia en que se apoyan las demás compañías.

27. Do you think the LPS was, or is, effectively carried out on this project?

n/a

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

Todo está bien, nomás es cuestan de tener responsabilidad. Es todo lo que hay que hacer. Si tú te comprometes. Porque ahí dice claramente qué está atrasando el trabajo.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

Estamos peor de lo que estábamos, sé hubiera empeorado. Porque eso es una forma de pushar a la gente. Pero si eso las palabras se quedan en el aire. Aquí está apuntado. Por eso es Bueno eso. Siempre y cuando tomemos una foto de eso, porque alguien puede venir a borrarle.

Interview #29

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?

Este es el primer Proyecto lean.

11. What is your understanding of LC culture and practices?

Lean está bien, lo que se ha hecho es el pull planning. Es similar. Si trabaja muy bien. Mientras todos hagan lo que se debe hacer si sirve.

12. What are some of the benefits of implementing LC in projects?

En el lean, si es igual al pull planning, si sirve porque sabes dónde están las otras compañías, en las áreas en ciertas semanas, ya sabes dónde vas a estar. Puedes planear.

13. What are some of the challenges of implementing LC in projects?

Si ponen un milestone, cierta fecha debe estar acabado. No veo algo.

14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?

Cuando empezó el trabajo, igual siempre hay una meeting, y ahí dicen que tanto se va a hacer. Llegando el primer día todo se ve bien, pero después se empieza a ver los problemas. En está vamos despacio de lo que fijamos.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
Todo está bien, ahí ponen las personas que tendremos, preguntamos que tenemos.
18. In your experience, do you think the LPS is complicated?
No es complicado, lo único aquí es aquí el trabajo es chico, para mi ahorita, como que no está funcionando. Porque el trabajo está muy chico. El foreman también tiene que trabajar en la obra, es difícil andar en las juntas y en el trabajo. Como en trabajos grandes, uno no va a juntas. Ahí funciona mejor para planear.
19. Typically, do you think subcontractors really buy into the LPS?
No, aquí en este trabajo no. Yo no, y pienso que ellos tampoco. Todos andan trabajando.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
La única será, no en forzarla, pero tratar de que le digan a nuestra oficina de traer más gente que se pueda encargar en la obra, para que la persona tenga más tiempo para las juntas. Pero para mi está difícil.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Si.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
No tenemos opción, si habla la compañía, ellos son los que deciden. Lo que hacemos ahorita es trabajar fines de semana.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
No creo que las prevenga, pero si te ensena que si pierdes dos te va a doler tanto.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Lo único seria que vengan los de la oficina, como los PM que estén incluidos en el lean construction.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Sí, me quitaron gente, lo único que puedo hacer es trabajar fines de semana.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Ha beneficiado.
27. Do you think the LPS was, or is, effectively carried out on this project?
Si
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Todo igual.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

Aquí está muy chiquito, no hubiera pasado nada. Estuviera igual. Estamos haciendo lean, pero creo que sería igual.

Interview #30

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This my second lean project.
11. What is your understanding of LC culture and practices?
The key is the scheduling aspect. Instead of pushing dates out, basically, they work to make those milestones happen. So its schedule driven. A lot of meetings. Pull planning. Putting all the people together. Finding issues that we foresee.
12. What are some of the benefits of implementing LC in projects?
If everybody participates and buys in, the different trades will communicate. You can make things run more smoothly in the field. As they know where everybody is working at the same time.
13. What are some of the challenges of implementing LC in projects?
It is poorly managed is the opposite. If they don't buy into this. They won't do what they say will do. If they put the sticky notes but they don't follow it. Garbage will be the results.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Management of how is handled. And everybody's expectations about what they should do. If people buy into this, great results can be expected.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
PM don't manage the day to day work on the field. So it helps them to understand what's going on. So they understand what work needs to be done and the expectations.
16. In your experience, what are the main benefits of using the LPS?
Management of how is handled. And everybody's expectations about what they should do. If people buy into this, great results can be expected.
17. In your opinion, what are the main challenges of implementing the LPS?
The issue is the change and it's something new. And you try to get people who have been in the industry for 30 years, to do something in a different way.
18. In your experience, do you think the LPS is complicated?
I don't think it's complicated.
19. Typically, do you think subcontractors really buy into the LPS?
The issue is the change and it's something new. And you try to get people who have been in the industry for 30 years, to do something in a different way. So I think until it proves itself about the benefits, more people will accept it.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Monthly socials for subcontractors, with presentations about lean. So you can try to educate people. I have attended to those social events. So smaller GCs may try it and find some benefit. It's really just people getting educated.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Not too much.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
One of the reasons is superintendents are very good trying to forecast issues. So in a way we are able to keep them busy so they don't pull out people. If you got a god superintendent that can do that, you will avoid that to happen.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
If people are honest about what they are saying and doing what they really then no. But the issue is that people say they will be somewhere and they not, then that affect us.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
n/a

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Not on this project.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I haven't seen this project incorporating the lean as much as I have in other projects. But you got to have buy-in from every single sub. If you don't that's when you get the affectation.
27. Do you think the LPS was, or is, effectively carried out on this project?
I haven't seen this project incorporating the lean as much as I have in other projects.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
n/a
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
It could, it's all based on the schedule, if things are not being followed as per the schedule, then things get messed.

Interview #31

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my second lean project.
11. What is your understanding of LC culture and practices?
I would say the culture is to basically to get everyone buy into the lean concept and have people be aware of what truly the concept is, what we are really trying to achieve. I would say it's a very helpful tool. I feel like when everyone buys it and we get the participation we need, we see the rewards as well the efficiency in production.
12. What are some of the benefits of implementing LC in projects?
I would say, a lot is safety, a lot of people are aware of what's task is ahead of time, because we pull plan. So it's giving us a very good approach. Also, I would say the efficiency trades coordination, all we have more interaction between our trade partners, we have our foreman

interacting with each other trying to solve problems on the field, ahead of time with the pull planning. Just to talk.

13. What are some of the challenges of implementing LC in projects?
Mainly would be getting your trade partners buy in, and showing them the advantages of what really it is.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Not on this project, but my previous project was the attendance, our main issue is getting the trade partners to participate in the pull planning.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Is the umbrella that incorporates every lean tool.
16. In your experience, what are the main benefits of using the LPS?
I think the benefits are being able to utilize the system for what it's really worth and implementing it.
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, I don't think it's complicated, is a very easy concept to understand. I think it's very straight forward to understand.
19. Typically, do you think subcontractors really buy into the LPS?
I think at the beginning they don't realize how beneficial it is, but eventually, they see that in the daily huddles and in the PPC. It's kind of like an eyed opening for them.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I guess just incentive them with breakfast or something, nothing major. And I think a lot of the buy-in is just having your trade partners give the system a chance. There is no another way they know how effectively use it until they are able to utilize it.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
I have a project where we weren't using the LPS.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Usually, if we are behind schedule we coordinate with the trade partners of the subcontractor and say hey, there are contractual deadlines, they try to make the dates.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I would say yes to a degree, just because we had the coordination and pull plan and every trade partner should be able to know the manpower they need for that task. So I figure there should not be manpower issues with the LPS. and if there is it should be minimal. It's more to manage the situation, it would be more of a tool, to get back on track after, jus to say the contractor to relocate the people. How do we make production wise or whatever?
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
I don't know.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I think it's very beneficial, because even though we are behind schedule, with the weather delays, we had a very good concept and understand how to recover the delay. Not being efficient in the way.
27. Do you think the LPS was, or is, effectively carried out on this project?
Yes
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I can't think of anything.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I think the schedule would have slip every aggressive. Just because of how many, we had like several days of raining, I feel without the LPS we wouldn't have the understanding of where we really are and how to solve it.

Interview #32

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
The last one was my first project.
11. What is your understanding of LC culture and practices?
I think what it does is basically generate activities that we can put on a schedule, so we can actually hit accurate dates for a master schedule.
12. What are some of the benefits of implementing LC in projects?
It opens other activities where I can actually sequence people into, basically like Tetris, I'm trying to fit other pieces into that sequence and generate and overall schedules so I can hit dates, and see where I can squeeze time.
13. What are some of the challenges of implementing LC in projects?
depending on the subcontractor. Once we get the pull plan using lean, they put too much buffer in the durations, it screws things out.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
My portion, I'm the guy in the midway, so they do a lot of lean planning if it's beneficial for them. They need to put more durations into the front end stuff, that way it's not affecting the others. Whenever you do a pull session, they always think about what they will be doing.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
I've seen it, but I've never planned with it.
16. In your experience, what are the main benefits of using the LPS?
The difference between the LPS and like other construction, is especially I see it more beneficial on jobs of a certain size. More for big projects. But the LPS is a necessity. The landscape dynamically changes by the hour. If we work plans, they are beneficial, more so to myself as GC, because I can see where they will hit the dates. It's always nice to track this.
17. In your opinion, what are the main challenges of implementing the LPS?

n/a

18. In your experience, do you think the LPS is complicated?
I was initially when I started, but after a minute is easy. I think the subs initially are very argumentative. They are not like. They say it's great.
19. Typically, do you think subcontractors really buy into the LPS?
Yeah, I think it's always the new sub that comes up and says. The flow of the job is always disruptive.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
That's the message. When we say if we have different subs, you can probably, take it to any level and see how they will perform, but there are other guys who can't. They are here for the quick job, small portion of the job. You can't really tell.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
The same thing goes for construction. Squeaky wheels get the grease. When activities and things like that we have to reflex on the schedule, and we start sending notices, then PM should work with them, so they can get back on track.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Absolutely. They plan what they will do, their activity and manpower. No, it wouldn't. it goes back into. It prevents because they know they have to keep the duration, I can't really do that. If they can't meet their contractual dates.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Every job is different. It's whoever screams a lot of this. It's just the way it goes.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
In particular, on this project, I wasn't part of the schedule. The activities involved in the last planning. In particular. Lean works if you trigger milestone activities. This time we had so many activities.
27. Do you think the LPS was, or is, effectively carried out on this project?
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
We are screwed. I don't know actually. More duration time in the beginning for setting up. Probably where we are going, more preplanning time. Identifying the major future issues. We didn't check this far ahead.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

Free for all, there would be no way to hold subs responsible for their durations at all. The whole thing that helps especially managing, it helps me triggering and keep the dates. Telling them accurate dates. Especially in production.

Interview #33

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

13. Have you participated in LC projects in the past? What projects?
Yes, my lean journey started with another project and this is my second lean project.
14. What is your understanding of LC culture and practices?
Its continuous improvement, it started with Toyota. With keizen and continues with all the Japanese concepts of continuous improvements. But I think it has changed, from continuous improvement to reduction of waste, find different things to be more efficient, just to continue to grow, to do better things. How can make this visual so everybody can see. What I love about it is about accountability, keeping your promises. Especially here at the jobsite where we need the trades to make it.
15. What are some of the benefits of implementing LC in projects?
The fact that you get more accountability with the individuals, increase conversations, face to face. Also makes it very visual, so that everybody who goes to the jobsite knows the expectations. Increase safety, because everything is organized, you use the 5s. It's a mentality it's a culture. If you go to a jobsite with this culture, you can easily tell they are using it.
16. What are some of the challenges of implementing LC in projects?
Challenges range from people wanting to do things the way they've always done it, nobody wants change, change is difficult. I think that's probably the biggest thing that we run into this business. They say why would I need to change? How the sticky notes on the wall will help me make more money? As soon as they see the benefits to them, most people get on board.
17. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Specifically, it's a moving target. Some of them just want to check the box, to say they completed it. An example, it's difficult in the LPS to get an accurate PPC, on the fact that we said we are going to do something, but a lot of parameters influence this, owner, reasons, etc. but when we grade ourselves on that day or the end of the week? Because we can stay later the next day and recover the previous day delay. Or we just mark incomplete? It's hard to judge that.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

18. In your own words, what is your understanding of the LPS?
It's exactly what it says, it's about making sure that the person who is placing the concrete or rebar or nailing the hammer to the nail, that he knows exactly what he is doing and how much he is supposed to do. Superintendents and manager are not the actually doing the work, so this is a mistake when scheduling with the. The problem is they don't understand the goal. So is literally getting the last person screwing the nail, the last one, to know what's the goal, so we all are on the same page.
19. In your experience, what are the main benefits of using the LPS?
The people who are doing the work are the experts in the work. Versus the superintendent of the GC sitting in a room, closed by themselves, and assigning times to activities. There are a lot of specs and drawings, so it will be difficult for them. The last planners can get the details and know the exact steps to do their work and know exactly how long it takes. Instead of guessing, it would take me 8 hrs. to do so many units, with their expertise, they can give you an accurate schedule, based on the real work. Not assumptions.
20. In your opinion, what are the main challenges of implementing the LPS?

Accountability part should be transparent, people don't want to say I can get it in four days, because they may not make that, so a lot of them put some buffer, they say give me 5 days, when the actual is 4. So we ask them, really is it going to take your 5 days? Because we lose the idea of this system, but if you say you need 5 we can work with that, but if in the end, you finish it in 4, nobody will be here to continue the work.

21. In your experience, do you think the LPS is complicated?
Is not complicated at all. It's time consuming in the front end, but then you can see the benefits in the end. A lot of people would say it's a lot of work to do the paperwork. But the LPS forces you to have that conversation every single day to make sure the contractors and the individual it's on track for what they say they are going to do. If someone has a problem we can deal with that, but if we don't have the LPS we don't talk to the guy with issues in the field. We need to wait until several days to find out there is a problem and they didn't finish due to a past problem. The LPS forces us to have that conversation.
22. Typically, do you think subcontractors really buy into the LPS?
I think they buy into the system later, I think they need to see the benefits of it. That's why we do the onboarding sessions, we allow them to learn what it is. If we educate them and then we show them the benefits, they will buy it when they see them.
23. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
There is always a continuous improvement. Because it's a moving target, if you put the LPS and say this is what it is, you eliminate the idea, as it should always be improving. Everything.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

24. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes, the LPS helps us to deal with them. When we look at the lean board, we ask for real productivity, how long does it going to take you? But you may have your team C on this project, and team A and B on another project, ok that's fine we are going to figure it out for our project. Let's have conversations to understand exactly what external issues that you may be having or internal. Maybe you need something from me or from another contractor, you have an opportunity to identify the issue. Maybe additional funds, or manpower.
25. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
I don't think there is anything that can be done, if we could predict the future we wouldn't be here, you deal with the unknowns as well as you can. In the huddle, we meet and talk about the different things going on, like fires or issues.
26. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I still put out fires every single day. I think you would back to the fact that you have to have the conversation that I understand that you may have other obligations, you still have obligations on this project. I think that it's an opportunity to revamp the plan, you can't prevent that from happening, but it gives you an opportunity to be collaborative. How can I help you? And how can I help you? Let come up with a plan as a team to figure it out how to solve this issue.
27. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
n/a

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

28. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
29. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Benefit. We collaborate in the project, with better results, and the owner greatly appreciates it. They see the expectations and gives us the direction on how much we got to produce. How do we get there? So everybody gets an opportunity to speak. After that, owners they ask you to do pull planning sessions, so they can understand the goal.
30. Do you think the LPS was, or is, effectively carried out on this project?
I think its continuous improvement, as we worked through different phases of the project, we found that it's more difficult in some areas than in others. There are so many variables that came into play, that we try to track with the PPC and be efficient, its continuous grow on the improvement side.
31. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
n/a
32. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
There is an important owner milestone in this project, if we didn't use the LPS, we wouldn't be able to meet that milestone. We would be needing to ask more money to meet the milestones that are changed by the owner.

Interview #34

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
We started doing lean probably about... we started a long time ago, we didn't call it lean. But it's kind of the same thing. Like on this project.
11. What is your understanding of LC culture and practices?
It works if everybody does what they say will do.
12. What are some of the benefits of implementing LC in projects?
It makes it go smoother if everybody does what they say will do. It's like coordination. It's like Lego, if the foundation starts right, then everything goes right. That's the benefit, if everybody does what they are supposed to, then it stays on track. It does help.
13. What are some of the challenges of implementing LC in projects?
Don't put fake dates. Put the dates you think really will take. You need to know exactly how many days to stay on track.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Not really it just goes back to detailing.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, it shouldn't be. If everybody knows how long is it going to take, is not that complicated.

19. Typically, do you think subcontractors really buy into the LPS?
I would say probably 75% of them buy into it. They don't buy it into it, they want to do their own schedule.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I think everybody needs to give a 100% try. Just do it. Don't talk just do it. There are people who actually realize the system does work.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Not on this project, but it happens all the time.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Mainly it's the PM really handles it, we call them and say, per contract you are supposed to have so many people on this project. it's all exactly what's in the contract, like a pushing strategy. The superintendent knows more about what's going on the field. And we say, we are not going to hit this milestone because you are delaying our work, so the PMs get involved. 9 of 10 times it's worked out. We can double man up over the weekend or something like that.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I don't think so, the lean system is just like a guideline. It's just what we need to do. Is like a set of drawings, you follow it, but not all the time, because drawings may not reflect what's on the field. It looks good on paper, but on the field, it does not just apply. But you try to follow the plan as you can.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Not really.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
It's a guideline, this job is delayed, but there are weather issues about it. You can't control it.
27. Do you think the LPS was, or is, effectively carried out on this project?
I think so.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Honestly, I don't know. I wasn't really in.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Lean does help, but before lean, we got projects done, the lean is just a method of planning a project. there could be things where a sub needs to know what is his tone, by having lean it makes the sub I'm going to be in this area and he knows exactly what he needs to do there, it helps them to focus on details. Conventional work you just go out there and do it. But lean gets everybody on the same

page. Part of it is every contractor needs to know kind of general idea of where to go or when. The subs need to communicate on when and what they are doing.

Interview #35

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Yeah, this company is big in using lean procedures. For about 5 years.
11. What is your understanding of LC culture and practices?
I haven't read the theory, but we use it, it works pretty well for making people talk. It fosters a lot of discussions, makes our job easier because we don't have to do things individually. It gives us challenges because it makes us accountable. If we don't communicate well, then it's going to hurt everybody. Generally, it seems a good practice.
12. What are some of the benefits of implementing LC in projects?
The biggest one is collaboration between trades. It makes us obviously more efficient, ourselves, we just have one conversation to solve problems as a group. Standardizing the way we do things, make it easier for us to use it.
13. What are some of the challenges of implementing LC in projects?
Everyone is tied together, the way we use it, if one person is left out or falls on the way, it would affect the other trades. So that's one thing. It kind comes to territory. It's important. It puts a lot of pressure on. We had one meeting with the subs, if there is something that we don't get before that timeframe, then that time become useless, if we are not prepared, there is more work upfront, but if you do your job correctly it's better.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
If there is no so much on this project, but on other projects with subs who have never been related to lean, they are hesitant to show their cards and put everything there. Make sure there are durations, they don't know. But generally, once you get guys in the room, they start to figure it out. From the field side, which is tied directly to the schedule, when we first started out, push all people, they need to tell you the info.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
I would say yes, some subs are not, they are the kind of guys who just want to do their job, the ones who understand it is because they don't want to. Because they don't do it, it hurts the whole team.
19. Typically, do you think subcontractors really buy into the LPS?
Yeah for sure, the ones who don't, are the ones having the hardest time keeping up with the other subs.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Get them as many examples as possible how, is not only, if they give us information, that's going to be a great benefit because we run the schedule, it helps us to increment the reliability of the schedule, it's definitely buy in from the subs what really feeds the schedule.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
We don't like it. Depending on the size of the project, in my previous project, there was about a week, they only had 15 plumbers, so what we were literally all over left except from 2, exactly what you said, they had another project, we weren't happy. We didn't really, it didn't become an issue, until the second day, and only lasted about a week, we said, make sure never happens again. If it happens continuously, you got a problem. Executives may talk about that.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think, so, that was a nice thing about that project, and what we are doing here, when we have buy-in from the subs, and they are giving us their weekly work plan, of they assume they will have certain guys and they don't do, then they obviously won't meet their target. It helps to proactively for them to tell us what they will get done, it won't prevent it, but it helps us track how big it is. To manage this situation, and we can show them, hey you said this and you did this.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
It's though. You could, I guess, depending on the job, how quickly it needs to get done, how severely. You could and what other trades are, you could, I guess, maybe try to back charge them for other people's time. Other than that I'm not sure.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
n/a
27. Do you think the LPS was, or is, effectively carried out on this project?
Yeah, I think so, we have done a lot of pull plan sessions, they have been very beneficial. We did the weekly work plan. Part of this is having these subs meetings. Those are intended to have everybody on the same page. I would say that I've never seen it running. It's usually it's a lot more office staff, it's not just what's going on the field. Field issue. Budget issue. This job obviously is a little different. It's just not how it was done in the past.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
More involvement from the office guys. But it's though because a lot of the subs are from outside the area, so it's not like I'm used to.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
If we didn't do that, all that would be is taking us the schedule and enforcing it with the subs, it would be a lot less coordination with them. I would say we would more time to work because we have so many meetings. But you got to think that over the course of the project they help. Because issues are eliminated during those meetings. A lot more aggressive between trades.

Interview #36

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Este es mi primer Proyecto lean.
11. What is your understanding of LC culture and practices?
Para empezar, es poner todos los días ahí esa junta, verdad, ahí se pone uno a entender entre los otros compañeros alrededor de nosotros, para que uno trabaje y después otro.
12. What are some of the benefits of implementing LC in projects?
Para empezar sí, porque así puede una compañía primero y después otra y trabajamos los dos juntos y así podemos sacar esto juntos.
13. What are some of the challenges of implementing LC in projects?
N/a
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
N/a

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No
19. Typically, do you think subcontractors really buy into the LPS?
No
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
No sé, todo bien.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Si
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Ayudar con gente propia.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
No creo
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
No se

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Sí, no nos amontonamos los contratistas.
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
No se
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Pasaría de que, por ejemplo, creo que hay compañías que tienen que trabajar, hay otras que van tras de ellos, estaríamos amontonados y no podríamos trabajar juntos.

Interview #37

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
4 proyectos en total.
11. What is your understanding of LC culture and practices?
Safety, planear, problemas que existan y resolverlos.
12. What are some of the benefits of implementing LC in projects?
Poder decirles a los trabajadores, que está pasando cuando traen material pesado, que sepan que está a su alrededor. Estar en contacto con ellos en cosas que podemos y no podemos hacer. Poner planear, el trabajo acorde con todos los demás subcontratistas. Si hay algún problema discutirlo entre todos. Poder entender si vamos a traer más gente o si vamos mal.
13. What are some of the challenges of implementing LC in projects?
Estar al tanto del safety. Checar bien a los trabajadores que no los corran de aquí. Que vayan a corde a las reglas de aquí.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
No, problemas no.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
To digo que está bien, no veo ningún problema con ellas.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No
19. Typically, do you think subcontractors really buy into the LPS?
Yo creo que no compran la idea.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
En realidad, tienen un Sistema parecido en cuestión de safety. Pero como por ejemplo las formas que tengo que llenar diario eso hacemos también en la compañía, pero no tienen el tiempo para planear las cosas que va en cada trabajo. No tienen tiempo ni gente para esto. Ellos saben a través de mí lo que hacemos aquí. No tengo idea de cómo mejorarlo.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Si
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Normalmente hablando con el super de mi compañía y el del Proyecto del que removeremos la gente. decirles que estén al tanto de lo que está pasando y ver cómo podemos ocuparnos de lo que es primario y lo demás dejarlo para cuando vuelvan.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Yo digo que si en cuestión de lo mismo. En saber que es más necesario hacer en el momento que otra cosa que se puede hacer después. Esta difícil ahí, porque no se sabe en realidad que pase en otro lado. Para prevenir esa situación eso nos ayuda en cómo no atrasarnos.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Hablando con ellos, planeando una estrategia que no se atarse.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Ha beneficiado.
27. Do you think the LPS was, or is, effectively carried out on this project?
Desde que estoy así, si está bien.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
No podría cambiar nada.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Yo digo que, si le hubiera afectado, porque cuando empezó hubo muchos días de lluvia, que atrasaron. No sabría en qué posición estamos, de no ser por el Sistema. Menos informado.

Interview #38

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This if my first.
11. What is your understanding of LC culture and practices?
It's a way to organize thoughts and activities so that almost anyone can walk in and get a general idea of what's going on. It helps with explaining things. Organize properly. You got visual aids and when you explain things, people can learn from 2 different aspects.
12. What are some of the benefits of implementing LC in projects?
It's related to scheduling and activities coordination. We use pull planning and 6 weeks look ahead boards. The visualization of the schedule with different colors, really helps anyone to see activities interacting. And also to find a group of activities that we could make in a short time. In a lot of cases by just looking at how they are connected. Also, the visual tools that we have everywhere, If

I walk into a trailer and I see that, I'll be able to navigate pretty easily over the tools. To say the names are over there and makes it easier.

13. What are some of the challenges of implementing LC in projects?
Incorporating it. The construction industry wasn't very lean. Compared to another non lean projects, it's kind of a night and day. It takes a lot of effort to get buy-in of the subcontractors. The change is difficult. Not necessarily the lean process.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Incorporating it. The construction industry wasn't very lean. Compared to another non lean projects, it's kind of a night and day. It takes a lot of effort to get buy-in of the subcontractors. The change is difficult. Not necessarily the lean process.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
It has a lot of different steps, from pull planning to PPC. So I understand all of the steps through that. I understand that you got the pull plan, the pull plan transforms into the look ahead boards. Which goes more detail into the pull plans. Your look ahead board should go day by day. And then your weekly board should be completed the week prior. And then use them as coordination scheduling tools. During the week it was planned for, checking as well the PPC.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, I learned it quickly, I think that it's more complicated getting people to understand, but the system is not.
19. Typically, do you think subcontractors really buy into the LPS?
Some of them. It depends on their companies' culture. For example, we got one subcontractor here who their manufacturing plan is lean and they incorporate different lean principles, so it's easier for them to catch up.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I think that you have to have some trust. Increase that in your sub.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes, not too much on this project, but yes in my other projects.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
There is a lot of phone calls and some heated conversations. Checking the original contract. Holding their feet to the fire. Making them commit.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I don't think there is anything on the LPS that could improve that, it's more about the subs commitment, but I do think that the planning system with the look ahead boards and the pull planning anticipating the crew number, I think that helps subs to know how many men they will

need, ahead of time they will need. I think it's a good tool but I don't think there is something it could do to prevent it.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
It's kind of almost that it has to become an industry standard. I think it's going to take some time, but once you get to the point where any sub no matter what is used to the last planner system, then I think it will end that kind of thing.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes. Pushing and contract.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Benefited. It's very easy to find critical information vs when we first started.
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
We could have made it a little bit more personal in the beginning in terms of 5S. The 5S lean ideas is basically organize your area and keep it clean, so we could encourage everyone with their own space. At least for some people to see the benefits of lean. So they can see those benefits.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I think we would be behind the schedule. Without the LPS, the pull planning system gave us a blueprint of the project and helped us to see what other opportunities we had and an obstacle presented. With traditional scheduling, we just had the P6 and bar charts, so it's hard to see the relationship with that.

Interview #39

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
2 projects in total.
11. What is your understanding of LC culture and practices?
Has to be with being on top of the project, being more organized, get all the steps to get on time on the project. helping subcontractors navigate through the project easier. So you don't have to deal with materials multiple times. Helping with coordination. Making sure that what's supposed to be first is done first. Walk on the site to have an idea of what's going on in the project.
12. What are some of the benefits of implementing LC in projects?
The biggest benefit I see is that it can help the subs save and make money.
13. What are some of the challenges of implementing LC in projects?
Keeping everything organized and having a constant flow, not just doing the stuff just for doing it, making it make sense. Also organizing with the team, getting everybody's buy-in, moreover with the subcontractors in the lean process.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
I think everybody wanted to do it, so I don't see those issues.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
I like the LPS, it keeps you organized it keeps everything in one place. And you can always track back.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
I don't feel it's complicated.
19. Typically, do you think subcontractors really buy into the LPS?
No, I feel the subcontractors want to come in, get their work done, they don't want to actually go through the process to get lean done.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Giving them incentives on actually doing the LPS, and also make it part of the contract that they have to do the LPS and get involved as well.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
It all depends on where you at in your project, you can allow for those gaps, but in most cases, we try not let the guys go out of the jobsite, because that will put us behind. Is talking, talking, and if we can buy one or two days, and they say I'll make it in four, we let them go and if it works for our schedule we let them.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
If all projects were using the LPS it would prevent it to happen, but if only some of them use it, it wouldn't prevent it to take those guys from the job.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
n/a

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Just being a little more organized, subcontractors are slowly understanding what we are trying to do with the lean process, like the pull plan that we use with subs, and they can actually can coordinate to see. How many days they propose to use. Real durations days, rather than just putting approximate dates. So it's a matter of collaboration.
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

Having a better organization and flow about lean processes.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

It could be more conflictive, more issues, more change orders. I feel like the process that we are taking now, keeping us from having those RFI and change orders, that's coming out because we are solving the problem ahead of time, so we don't have the issues. And it's giving us an opportunity to talk to the subcontractors so they put their brains in what they have already, and not telling us to put that on the board.

Interview #40

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Este es mi primer Proyecto.
11. What is your understanding of LC culture and practices?
Planear a futuro, una semana o dos semanas por adelantado.
12. What are some of the benefits of implementing LC in projects?
La coordinación con las otras compañías
13. What are some of the challenges of implementing LC in projects?
Llegar a la meta. Creo que estamos trabajando bien.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
No tuvimos problemas.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
Es muy sencillo y fácil de trabajarlo.
19. Typically, do you think subcontractors really buy into the LPS?
Al principio, si, se comprometen.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Checar todos los días, coordinar con los demás grupos

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Si suele suceder.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Intercambiar la gente con otros proyectos, pero no dejar atrás el Proyecto en curso, si tenemos tareas, tenemos que pedir más gente. No puedes quitar el número de gentes. El día que tienes calculado ese día tienes que tener con la gente que tienes.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Debe prever.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Desde el principio planear que tareas vas a hacer y con cuánta gente vas a poner. Es lo que hacíamos al principio. Si iba a afectar a otras compañías, teníamos que ver cuánta gente necesitas para la tarea. Y ya planeas para la semana.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No, al contrario, hemos estado incluyendo gente según como avanzamos.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Ha beneficiado mucho. En planeación y coordinación.
27. Do you think the LPS was, or is, effectively carried out on this project?
Yo creo que es efectivo, no hay mucho que mejorar.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
No se me ocurre algo.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Estaríamos retrasados con el schedule, con las tareas. Por falta de planeación y coordinación.

Interview #41

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my first lean project.
11. What is your understanding of LC culture and practices?
Is an idea or methodology for organizing your site or project, your staff to minimize waste on all of its forms that are very common in construction. Materials, time, effort. Any locations of waste that you can find. To maximize the value in the project.
12. What are some of the benefits of implementing LC in projects?
When done right and when everyone is participating, you can save a lot of time, by catching up mistakes before they happen. In this project we recovered a big amount of delay, we did pull planning with the trades and were able to recover the weather delay. They realize how much simultaneous work they can do, which improves the schedule.
13. What are some of the challenges of implementing LC in projects?
In general, in theory, is very efficient, but in practice, it is difficult to implement it. The system was faulty if not everyone participating in the system. They are still trying to develop lean into a program that could be implemented by practitioners. Is up to project leaders to choose the correct tools of the LPS that meet the project needs.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
They are still trying to develop lean into a program that could be implemented by practitioners. Is up to project leaders to choose the correct tools of the LPS that meet the project needs.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Is lean with a different name. it looks like they are trying to sell the idea with a new name or extra tools. To get people on board with the same culture and process.
16. In your experience, what are the main benefits of using the LPS?
Same as lean. You plan for the future. For your milestones. You must have done certain things on certain days. Keeping them on mid and working backward.
17. In your opinion, what are the main challenges of implementing the LPS?
Same as lean.
18. In your experience, do you think the LPS is complicated?
In theory no, it's actually straight forward. In practice, sometimes it's complicated more than it needs to be.
19. Typically, do you think subcontractors really buy into the LPS?
No, but usually it takes, the general contractor supports them to see the benefits. Then slowly get people on board. If you get some people of them on board the rest will follow them, by pressure.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
n/a

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes, it's relatively common. They are expecting to use the same crew in different sites, so they can improve profit, but that is a problem for projects.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
We worked collaboratively. That was 6 weeks before the issue. Then they relocated resources to that project, so they had to plan accordingly.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Currently, most of those issues come up during pull planning sessions, or weekly work plan, or milestone schedule. So I think those tools are useful for bringing those issues on time to fix them. I'm not sure if it prevents it, but the key is finding it as soon as possible.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
n/a

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes, we found that issue through pull planning. We worked collaboratively. That was 6 weeks before. Then they relocated resources to that project, so they had to plan accordingly. Also, you go through his contract, to see what we required him, so usually is a relatively polite conversation. What can you do to fix this? Can you change your schedule different? If we move this what happens? Just collaboration.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Yes, I would say so. In general saving time. Because not all subcontractors are deep, we are trying to make them all see the benefits. But schedule-wise, you can see the benefits. Organization with

- the 5s, and the rest of the tools. We can act quickly when an issue happens. Saves a lot of time. If you minimize the messy of a job, it can save a lot of time.
27. Do you think the LPS was, or is, effectively carried out on this project?
The industry is trying to figure it out what's the correct way to apply it. And it will take time. A lot of people are trying to fix this.
 28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
n/a
 29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Specially on this project, with the client very close to the project, and a challenging project. In theory, we could be ok as well, but it may be more difficult to perform well. Sometimes clients have their own use of the LPS, so we have seen they see the benefits. Maybe more impacts on the schedule. Less transparency.

Interview #42

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
No this is my first lean project.
11. What is your understanding of LC culture and practices?
Pretty much a way to figure out how to solve problems all the team. A lot of preplanning. Realizing about the issues. Looking out 6 weeks ahead. Looking at what you will need. Instead of just looking at tomorrow.
12. What are some of the benefits of implementing LC in projects?
Planning. Like the pull planning we did today, benefits are that you can be prepared to that. The schedule is the difference because we all talk at the same time. instead of individually. Planning as a team.
13. What are some of the challenges of implementing LC in projects?
The new aspect of it. And a lot of people don't want to try new things.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Yeah, we are still going through. It goes back to... people have done things in a certain way for their whole career. A lot of people can tell that don't really care about this. Kind of afraid of writing notes in the sticky notes and putting them on the board.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Yes, I know the system.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
Not really. I don't think it's complicated.
19. Typically, do you think subcontractors really buy into the LPS?
I think some do, some of them not so much. Sometimes people put the steps just do it, and they don't really think about that to really make it. You need to be honest about what you think can actually be done.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?

Not really. It's just going to take a period of time for people to get comfortable with it. To put it on the spot for all the peers. Some of the people struggling with it right now are fairly new to it. They are new to it. I think is just the overwhelming thing.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
You just got to their boss and say we got problems here, you got to take care of this job also.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I don't know how much it can really help if you go through the lean system. But if somebody is short on manpower, then there is not a lot you can do about it. You can prepare for this job, but if the electrician boss he needs to send 2 guys to finish another job, lean does not help at all.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
It's an outside factor. That other job should have been planning accordingly. When the system pushes you to plan accordingly. The external projects should use the lean system.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes, we just go through it. We talked to the companies about getting more people, they tried and some days they got more, sometimes they didn't. because you know especially when you hire somebody in a day they need to go through all kind of requirements.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I think it has benefited the schedule and manpower needs.
27. Do you think the LPS was, or is, effectively carried out on this project?
Yeah.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I'm not sure. This is my first lean project. I don't know.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
We would be way behind the schedule. Because there are too many things that get found in the huddles and the weekly meetings. When we have everybody together, we do brainstorming to solve the issues. It puts not pressure but it's accountability on the whole team. And you don't have that accountability without lean, the superintendent has to talk one by one.

Interview #43

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Yes, I would say probably over the last 8 years, about 60% of them.
11. What is your understanding of LC culture and practices?

Some people like to sue the term of micromanagement. You turn to break the job down into sections. And you coordinate what it's going to take. And all trades are having input, so when you do all the planning and have their professional input on how to manage the schedule. So each trade needs to maximize their efficiency. Then by getting everybody together, it brings up the other trades saying I need to be before or after you. Whether you go on one side of the building if you want to do your production in multiple floors or just one section. It develops a good ability to coordinate and communicate. And kind of move forward there.

12. What are some of the benefits of implementing LC in projects?
It leads to fewer conflicts, fewer people working on top of each other because most projects have very little storage space. The storage and materials it's going to install. By these meetings, it gives you the ability to say, coordinate work. Basically, it's common sense things that people experience on job to job. Have the ability to bring that up and be open, whereas the people looking at their offices. And if they don't make that schedule, they say, we have 6 months to complete this. Because we want to put 80% of the first months, if you don't do it properly, it will be a big issue.
13. What are some of the challenges of implementing LC in projects?
When everybody kind of sets their schedule and material deliveries and everything else, with the lean method has enabled to enhance your ability to get everything organized, when somebody in that link doesn't do their work, it creates a backlog. Puts a speed bump in the operation. The constant huddles that you have every morning, you get the chance to meet up, discuss the problems and find solutions. Therefore, you kind of maximize the ability to get back on track.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Basically, the first trades are essential to be on the schedule, because in that phase on the beginning, some trades have the most work.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Oh yes.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
Everybody has to contribute in order for that to work. In a lot of cases when it becomes a requirement. The opposites work through the daily work plan. It doesn't take a lot for the superintendents to get on track on that. Not be using it. And then whoever is constantly being throwing back. It's kind of the situation. Some trades they go through one time. they don't come back later as often. We are affected by a lot of trades. Anything that's out of sequence affects us. If they are out, we get out. I can be not finishing one sequence and then the three weeks look ahead.
18. In your experience, do you think the LPS is complicated?
It can be if you follow it is simple.
19. Typically, do you think subcontractors really buy into the LPS?
I think that there are certain ones, and some absolutely don't.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I think that having a team on the GC that is very understanding and communicative and able to receive information. Rather than just give them. What we have here is a team that is very interested in the communication. Very interested in working together.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

Yeah.

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Basically, have to make the best of it. We experienced it. In this project, we had that issue, labor scarcity. Undertrained and under experienced people. So it was hard. So we did a lot of quality control as much as possible. You have to talk to the people and explain them why.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I really don't see that it creates anything bad towards that because really my opinion of the lean construction methods is to enhance the communication. To enhance the opportunity to do a better job. Therefore, if you had the constraints from manpower. That would give you the opportunity. Without the burdens and overpopulated of the area. So you can do your job properly. As long as you take of the problems, if you avoid them, you waste time by making corrections. Lean methods only help.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Really there is not a lot you can do about. Sometimes you do your job well. But sometimes you can't be keeping up, or they are not using lean methods. Or they are populated areas with different trades. If they don't hear complaints, sometimes they pull people because you are ok.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yeah, I have. You do the same thing. You say, ok this is my problem. Try to create ways to solve it. It is what it is. There are situations on jobs where you can't do anything.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
n/a
27. Do you think the LPS was, or is, effectively carried out on this project?
I do, very much. I'm impressed how they handled it.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
There are decisions from some trades, on which input from me and my company wasn't used, and so, therefore, it created a situation on the project that delayed the project, it changed the way the building was built, it stopped us from building it correctly. At that point, they didn't take it seriously. Now they want me to have that activity done, but it got complicated later. This delayed that activity. It created more trouble than what is worth.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I think we would be that a schedule is created without the input from the trade, and therefore it puts every at a disadvantage. If you put all trades everybody will be involved. They say we know what to do. And make the decisions. all they do is just keep pushing you on unrealistic points and values. Deadlines. A situation where it costs all subs money. They are over managing it. And working overtime. A lot of extra expenses. Due to a lack of your input in the planning. It's harder for subs to eat that cost.

Interview #44

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?

In my company, there are lean champions, in this case, is myself for this project. In collaboration with the superintendent, we conduct the lean training and procedures for this project. In 3 projects with this one.

11. What is your understanding of LC culture and practices?
The root of lean, you can break it in different umbrellas, but I would say the highest tip of that is trust. You see the schedules where people have 10 or 20 days, you go and work with them. Or when you start a work with lean, you start asking yourself, how many days do we really need for that? You get the feeling of this. And they sit down and they tell you a lot of what can be taken. They take a lot of this that has been on stickys. And they say no no, I got to before that or I can start with this and then you can kick off here. that eliminates waste in schedules. Usually, schedules are made by schedulers. It's one guy in a conditioned office who has never go out to the site. Lean is about collaboration, bringing people together, understanding what those first steps should be taken. And it makes sense.
12. What are some of the benefits of implementing LC in projects?
When you are waiting for either information or other trades, that affects your financials or even more. They don't like all the stress until you are ready, oh we are not ready for you yet. When you do the lean process, you ask these guys every day if they are ready. That makes it flow smoothly. That is the benefit I see. The other benefit is building that trust, from subcontractors that you don't know. Because now you start seeing projects coming to a lot tighter and a lot quicker. Lean is not a push scheduling. Push is basically saying you need to get it done. That mentality is gone. Lean is about communication and being open up front.
13. What are some of the challenges of implementing LC in projects?
Lean is great, but if you want of thinking about it as a military style stuff. That's not going to work. You have to have people with you in the lean process. it's almost like when you hear challenges of contractors not understanding the plan. If you are in lean and fully understanding and push these boards, and a trade doesn't really buy it and sees the rest of the trades following it, it will kind of follow it. He is going to understand and say, these guys have a relationship, nobody wants conflict. Without lean, it was always conflicting. Yelling and screaming all the time. because always was the assumption and lack of communication. So then just frustrations.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Yes, the issue is up front before you even show up to the job. You need pretty much lay out a flow of work. Of when you're supposed to be installing, how many guys you need. If you don't know this, it's chaotic. The stress will be hard to understand and defeat.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
I kind of consider this as a safety net. If you're working with your schedule and its working great, it doesn't give you the benefits. When you implement it, when you have challenges, people gets deep into it.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
You kind of relate it to a 1000-piece puzzle, you look at it and say what? A project may take up to a 1000 stickys. And you say I can't even think about a 1000 stickys. You zoom it and say break it down and chopping it, and then add stuff. Then you make the entire schedule.
19. Typically, do you think subcontractors really buy into the LPS?
They do. I've worked with contractors, when they know this is a supporting tool, and managing it directly will support them, they all buy it.

20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?

The core of the entire lean process is to be broadly and generally understanding how the flow works. These things, are the things anyone should know. After understanding the flow stops the learning curve, it hits them because you see the benefit. It's understanding flow. That is huge, if you don't if you don't agree with it, it's kind of slow you. I would suggest work with the subcontractor, build theirs before you try to go abroad because they are the ones understanding what's going on behind this

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

I've heard stories where that benefits them. Some subcontractors, you always have to be mindful of them, and understanding they are an extension of your labor. Without that, there is no only you on this.

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?

Prior to lean it was more, I need you done by Monday, and the other is I had no idea about that, so that's no possible. With lean you are pretty conscious about this. When you're building a schedule you also put a sticky for installation. And you ask questions, why you need that here? and then say what if we do this, and agree to alternative options we didn't know we can do. So there are fewer problems with labor and financing. So I commit to them, and they will commit to me the same way.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

If that's the one thing that could take you there? It's really to the person, if you reject it, it's never going to work.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

It would probably be the pull planning sessions, when you do that before starting the work. You can't automatically understand where are you on the line, where your team understanding is.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?

n/a

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?

It's going to end on, I wouldn't say in a schedule, but it has the chance to meet the schedule if not less than the scheduled time. is more for ensuring. Is not less time because you're pushing, is less time because there are comfort and trust to do it. And if you dig down, you seem to be conscious what you can do. It comes to the head real soon, at the end. More on the owner's side, you get a loan, you pay interest on the loan, the fewer months you take to pay the loan, you can operate to pay it. So lean does cost more, takes more time, on supervision, but when you're thinking big picture, on percentages, the value is great.

27. Do you think the LPS was, or is, effectively carried out on this project?

We are not there yet, give me 6 months, and definitely, know how to operate this. Right know yeah, but we haven't executed it fully yet.

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

n/a

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

The schedule would be delayed, there would be an excess amount of change orders in the sense that you didn't question upfront, you are not talking in detail. This time may be thinking of providing this and that. Typically, that would be where delays and change orders occur. That's what is the tradition.

Interview #45

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?

No, este es el primero completamente lean. En el pasado usábamos algunas herramientas. Como constraint log, daily huddle, pero no todo el Sistema.

11. What is your understanding of LC culture and practices?

Este, lo que yo entiendo de lean, es tratar de eliminar tiempo perdido, tratar de ser efectivos, no perder tiempo, planear, y que lo que estas planeando en realidad llevarlo a cabo. No nada más que se quede en planes que se haga como se planeó. Y haciendo updates dependiendo de cómo se van moviendo las cosas.

12. What are some of the benefits of implementing LC in projects?

Yo creo que la coordinación, que todos los subs trabajan en equipo. Y todos saben lo que la otra persona está haciendo. Y saben de qué depende la gente. Entonces siento que se involucran más y se dan cuenta de cómo va a afectar su trabajo. Porque usualmente sin lean, no se dan cuenta de que si no acaban en tiempo, va a afectar a todas estas personas. Creen que su trabajo es lo único importante. Pero lean hace que con toda esa coordinación todos se den cuenta de los componentes como van a afectar el Proyecto.

13. What are some of the challenges of implementing LC in projects?

El set up, al principio el tiempo perdido, porque tienes que poner todos los boards, planear tu área, tienes que coordinar muchas cosas, antes de iniciar el Proyecto, entonces, el tiempo que tienes que invertir. No solo puedes decir que el Proyecto es lean. No es complicado, pero el tiempo es significativo. Después es complejo hacer las mejoras continuas, debes buscar cosas que fallan, que mejorar, proponer cosas nuevas, entonces siempre es un ciclo.

14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?

El tiempo del setup.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?

Es usar todo el sistema, todo lo que involucra. A mi opinión en este proyecto es todo el sistema. Es usar pull planning, constraint log, PPC, y todas las herramientas del LPS.

16. In your experience, what are the main benefits of using the LPS?

En este Proyecto perdimos tiempo por las lluvias, con este Sistema pudimos planear todo y sentarnos con los contratistas y ver cómo podríamos recuperar ese tiempo perdido, entonces, siento que sin el pull planning, no hubiéramos podido acortar ese tiempo. Y de hecho ya vamos a casi recuperar el tiempo. Otro beneficio es coordinación. Todos tienen commitment dates. Entonces se comprometen a hacer su trabajo. En el tiempo en que dijeron y si no, se ve mal que no lo hayan cumplido. Siento que es más de la gente en realidad comprometerse a lo que dice.

17. In your opinion, what are the main challenges of implementing the LPS?

Ocupas dar mucho entrenamiento, no solo a tu staff. Debe haber un coach que tenga un training específico. Del lado de los contratistas, debes invertir tu tiempo en ellos para que puedan entender

- lo que quieres hacer. Por eso estamos haciendo el initial training. Estamos hacienda eso para que puedan entender lo que es lean y lo que estamos tratando de hacer.
18. In your experience, do you think the LPS is complicated?
No. Una vez que lo explicas, creo que es muy fácil de entender.
 19. Typically, do you think subcontractors really buy into the LPS?
Depende de la persona. Lo hemos visto en los onboarding sessions. Algunos ya han trabajado con el Sistema y les gusta. Otros no le entienden. Ya que lo entiende les gusta. Otros definitivamente, son old school y no les gusta. Pero no he visto a alguien que al final del tiempo no les guste.
 20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Sería bueno que tengan un coach, que te ayuda en todo el proceso. Alguien con experiencia en esto.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Si, en otro proyecto.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Usando overtime. Creo que una solución sería usar pull planning. Si hubieran usado el Sistema en ese Proyecto, hubiéramos visto qué no íbamos a acabar a tiempo. Buscar otras opciones en vez de mover gente de un Proyecto en el que tenemos responsabilidades.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
No que yo sepa. Pero haciendo pull planning y poniendo y poniendo tus constraints, puedes ver a futuro que es lo que viene. Yo creo que, si sabes qué va a pasar puedes planear, y ver de qué manera lo puedes manejar mejor. En lugar de esperarte al momento de tragedia. Puedes coordinar mejorar las actividades y contratistas.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Los subcontratistas aplican LPS a todos sus proyectos. Hasta cierto punto lo hacen, pero siento que ya cuando la gente está en proyectos deberían de seguir planeando.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
N/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Ha beneficiado. El constraint log lo tenemos en varias juntas. Ya que planeamos para los problemas futuros. También en el update del six week look ahead planning, ya que si son malas noticias las van a saber todos y con anticipación. A menos que sea algo inesperado como un equipo se rompió.
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Mejorar nuestras staff meetings y daily huddles. El punto es que tienen que ser algo rápido y a veces nos tardamos mucho tiempo en lugar de algo de 15min nos tardamos hasta 1 hora, porque empezamos a hablar de otras cosas y otros temas.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

Atrasados en una actividad grande que estuvimos atrasados por el clima. Siento que no hubiera sido el nivel que tenemos ahorita, que vamos a recuperar el tiempo perdido en esa actividad.

Interview #46

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my first one.
11. What is your understanding of LC culture and practices?
Is a very good program, because it coordinates everybody in a visual way. You use the boards. There are no excuses that you don't have enough information to coordinate the work. Everything is simple in the boards. As long as there is a participation.
12. What are some of the benefits of implementing LC in projects?
The main thing is the coordination that we have. Once you put it in a pull plan. At any time, everybody can go and check it and then go to the field to check it. They don't even have to ask questions, they just need to go to the board, they look at what's going on there. We can admit these dates, because of weather issues, drawing issues. But we get to there once in a time. Changes update pull plans. That's why the participation means a lot.
13. What are some of the challenges of implementing LC in projects?
Participation is the key.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Up to now, not really, it's one of the things that there is you can straight the line right away. It's a daily program that we implement every day, and that we make changes as we go. They will be told not to do changes on a daily basis, but in some instances, like weather, we have to do it. The challenge is to make up with this delay. Get back the days that we lost.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
This is my first job with lean, so I'm learning. After some time, it looks like everybody is grasping it.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, it's not complicated.
19. Typically, do you think subcontractors really buy into the LPS?
I would say 95%. Once they see the job progresses better, they will buy in. not at the beginning.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
As an owner, you should be aware that it could make you make more money. So it's about show them the system saves money.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

- Yes
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
You come back to the pull planning, you have a schedule to meet. If you see the contractor is lacking and is not ready, you start telling them they need more people. You provide them with notices. Otherwise, you bring another company and charge them.
 23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Yes, it prevents it in a way that they are accountable in the pull planning session, they have to meet certain dates. All companies will know because of them we won't be able to get this on time. Including general contractors.
 24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
n/a

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
n/a
27. Do you think the LPS was, or is, effectively carried out on this project?
It is in a way that nothing has gone so far. To me, as I've never used lean before, and now that I'm using it here, I see things in a different way. You know things on time.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I can't think of anything, everything is running ok.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I've seen big projects, on which you get to the point that people get frustrated, where they don't want to work with each other. They don't know what the other did. And usually, in other jobs, you have also daily huddles. So in a way to compare bigger projects. The pull plan has a lot. The respect with other projects.

Interview #47

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Este es mi Segundo Proyecto.
11. What is your understanding of LC culture and practices?
Apenas, en el Proyecto anterior, fue algo que a mi punto de vista era una pérdida de tiempo, en este estoy viendo como que están tratando de que funcione, pero al mismo tiempo pienso que, Bueno en lo personal, no tengo mucha experiencia en él y creo que varias de las personas que están en este Proyecto tampoco tienen mucha experiencia.
12. What are some of the benefits of implementing LC in projects?
Si realmente se cumpliera, o fuera un poco más realista. Yo pienso que muchas veces el problema radica en que se hace una, no son congruentes las cosas que están proponiendo conforme al tiempo que se lleva. Y yo siento que muchas veces hay discrepancia y no toman en cuenta factores

externos. Factores que no están considerando. Si se consideraran esos aspectos a lo mejor si hay beneficios. Porque no me ha pasado todavía.

13. What are some of the challenges of implementing LC in projects?

El tratar de mantener y conservar las fechas. Que lo que se proponga que se trate de conservar. Es como te digo, por ejemplo, en nuestro caso hemos tratado de conservar las fechas, más sin embargo han pasado cosas que no estaban consideradas y que nos afectaron. Tratamos de conservar las fechas con tiempo extra para lograr mantener esa fecha límite. Y el cambio no se ha conseguido.

14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?

Como que no estamos muy familiarizados con eso, entonces muchas veces las personas que tienen el mando en esto, dan unas ideas erróneas, o que no están bien estudiadas para saber si se va a poder cumplir o no con las fechas y con lo que se puede hacer.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?

Ese a penas que es la primera vez que lo estoy usando. En el otro Proyecto teníamos juntas y cada quien ponía sus fechas y así. Por lo que he visto hasta ahorita aquí, si funciona, pero volvemos a caer en lo mismo. Muchas de las veces las personas que hace eso realmente no tienen el conocimiento de cuanto es el proceso que se toma para llegar hasta cierto punto con las cosas. Ellos pueden poner para tal día vamos a tener esto y vamos a acabar esto y como va a ser lo otro. Pero no dan cierto tiempo de margen de error por cualquier cosa, cualquier adversidad. Deberían contemplar ese poquito tiempo, como un colchón. Aquí por lo que he visto, y luego pasas y preguntas lo cumpliste o no. Y pues la verdad no.

16. In your experience, what are the main benefits of using the LPS?

n/a

17. In your opinion, what are the main challenges of implementing the LPS?

n/a

18. In your experience, do you think the LPS is complicated?

Si las personas que hacen esto, tuvieran cierto tiempo para cualquier contrariedad a lo mejor no sería complicado. Porque podrías cumplir con los sticky notes como se está proponiendo.

19. Typically, do you think subcontractors really buy into the LPS?

Yo pienso que muchas personas no lo toman tan en serio, y ahí vienen los problemas. Si unos si lo toman en serio y otras si, las que los hacen solo por hacerlo, afectan a los otros. De los que estamos ahí, yo pienso que 50 y 50.

20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?

Pues como te digo, yo pienso que sería dar al final de un mes o una semana, dar uno o dos días extra para cualquier contrariedad y poder. Entonces si dieran esto para poderte poner al corriente, porque si ya no cumpliste un día, mucho de esto es una cadena que ya no pudiste cumplir después.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

Sí, es algo que yo pienso que pasa y no solo en este Proyecto, ha pasado en muchos otros antes. En los que se les atora la carreta en algún otro lado y pues sabes que aquí ya la llevamos maso menos déjame quitar 2 o 3 para mandarlos a otro lado y después aquí, es una avalancha.

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?

Aquí lo que han hecho y que maso menos funciona es que trabajan tiempo extra. Lo trabajan ya sea los fines de semana, como la semana pasada que se trabajó sábado y domingo o como le han

hecho, por ejemplo, que lo hicieron hoy, entraron a las 3am para poder cumplir el tiempo de producción que iban a tener, para poder llegar a este punto.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

Si cada cierto tiempo se diera un día de gracia, sin que contara como tiempo extra, sino que nada más fuera uno para reajustar cualquier inconveniente que haya. Ahora no creo que lo prevenga, con él colchón sí.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

Un colchón de un día, para todos, no solo para uno.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?

Si, la semana pasada que tuvimos que trabajar sábado y domingo para poder tratar de llegar a eso.

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?

Es dependiendo del punto de vista que lo veas. Si era para llegar a una fecha y tener todo listo, en general para todas las compañías, es decir esta es la fecha límite. Que le mencionen el hecho de que las cosas se trataron de hacer de una u otra para llegar a esa fecha, por circunstancias ajenas no se pudo, Bueno eso ya fue algo diferente. A lo mejor si sirvió, a lo mejor si no se hubiera implementado algún Sistema o algo diferente, a lo mejor no se tendría a esta fecha en la que estamos. Si recuperamos el atraso, no fue la fecha de un principio pero quedo cerquitas.

27. Do you think the LPS was, or is, effectively carried out on this project?

Improving

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

A lo mejor es su segunda vez como conmigo, pero ya con la practica podría mejorar.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

Yo pienso que se hubiera alargado un poco más, en el sentido de que, a la mejor, aunque las personas que tuvieran el mando o las personas que les urgía este trabajo dijeran sabes que tenemos que acabar para esta fecha, si faltaría un poco más de organización como dije en el otro. No tuvieran esto en un principio y ya lo pusieron mal, era un caos.

Interview #48

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?

No this is my first project.

11. What is your understanding of LC culture and practices?

Very basic, I'm just getting a hand of it. It's something that actually benefits the company itself and their employees, how to push and meet their target dates. Is very effective is utilized properly.

12. What are some of the benefits of implementing LC in projects?

Meeting the dates when we have a schedule and even daily huddles that we do, there we mention to people where we are and what we need to do the next week. And safety.

13. What are some of the challenges of implementing LC in projects?

This is something new for me, I wouldn't know if that's a challenge or just something normal.

14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?

Not really, this is rather new to me, it took some time getting used to it.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, it takes a little to get used to it, but I don't think it's hard.
19. Typically, do you think subcontractors really buy into the LPS?
I believe so if you have the right people with the right tools and they show them how to utilize them.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Not really, maybe just the fact of explaining a little bit more.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
It's actually happened to me here, one of their subs they took it them out 2 weeks, that's a big no no. if they are out, they are out. That's the only way to do it. Because the good behavior they have here, not necessarily take it back. We need to train them again.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Maybe we had a little more training it may be beneficial, but right now, I don't know how it would be negative or positive.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
The only thing is saying no to the, once they get started, they want to do it all the time, if you take them out don't bring them back.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes.
26. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I wouldn't know how to answer that. Nothing comes to my mind.
27. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

I believe this is a little more efficient. If this wouldn't have been implemented I believe we would be behind in our work, less focus on our target dates. That's a problem for all the trades, because there is always lots of people involved.

Interview #49

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my first one.
11. What is your understanding of LC culture and practices?
Is cutting down on waste, essentially, making sure that you're not doing anything redounding, that will not be able to allow you to complete on time, wasting money. Using effectively the resources that we have.
12. What are some of the benefits of implementing LC in projects?
Pull planning, because it makes sure everybody is on the same page, is better than the subcontractors doing it through the superintendents, because subs know what they can and can't in that time frame. My favorite is pull planning.
13. What are some of the challenges of implementing LC in projects?
The biggest one is time consuming a little bit. In the meetings, you feel like you spend too much time on that. Because the subs buy it in the pull planning, whether they like it or not.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
n/a

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
We work back from milestones and make sure that we get there on time, everybody is involved at the table. They let everybody know about sensitive items. We try to solve issues. All brains in the room.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
I don't think it's complicated, I think sometimes they overcomplicate it when it's simple. I think a lot of the lean concepts we learn are first-grade level, which makes sense, but it may be overkill like taping the napkins location, seems silly to me. I don't see how that helps on the bigger picture on the project. I just think that portion may be too much, but I think in the sense of cutting down time, waste, cleaner sites.
19. Typically, do you think subcontractors really buy into the LPS?
Yeah, once they use it more, some of these subs have not seen it. They see the benefit on this project. after they get more work, they will understand they benefits. With more subs involved, it will be more noticeable.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
That's really hard. I doubt there's a quick fix for that. They are not used for that. There are a lot of guys in the industry for 20+ years, obviously, change will come with resistance. Maybe with the new generation that will happen. The younger generation.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
No, I have not yet.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
But I have experienced when a sub is not meeting the dates they said. It's a little bit hard to deal with. You have other sins behind them, this one leading the way. There is no much that you can do. You can send more resources and work really hard. It's a hard position for me to be in. Because I'm not one of those finger pointers.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
It's holding them accountable to a certain extent. We meet every week and they have their milestone set. They need to complete their boards. Everybody knows what to expect. I guess it won't prevent it to happen. I don't think there is anything that prevents it to happen. Not even lean.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
n/a

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Benefited. As leadership is involved everything is running well.
27. Do you think the LPS was, or is, effectively carried out on this project?
Yes, we have done well so far.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Honestly, understanding it a little better. Putting some value towards lean. Everybody is talking about the topic. But actually putting value and understanding how exactly this works, every piece, because things sometimes get lost and don't see the big picture. Not only meetings and meetings and meetings. Putting values to it is the answer. Asking why we do things?
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
We would be hurting. I can tell you we would be delayed at this moment without lean. We were supposed to finish some milestones, but weather conditions caused the delay. With a pull planning session, we were able to recover the delay with a plan. And it worked. You can't see those ideas by yourself, getting everybody thinking together makes that change.

Interview #50

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
6 projects in total.
11. What is your understanding of LC culture and practices?
To better schedule and coordinate the job, to eliminate waste and better value for all involved. The subs, the owners, the GC. Everybody create a whole better atmosphere. When things are going smoothly. Everything goes smoothly.

12. What are some of the benefits of implementing LC in projects?
The team building, the coordination, the more communication, it brings a lot of guys out of their shell, to come out and work every day, it gets them talk more, and the more they talk as a team, the better they coordinate.
13. What are some of the challenges of implementing LC in projects?
It's getting the guys communicate, honestly and truthfully. People may come and tell you what you want to hear. Just to keep peace in the crowd. So the main is truthful communication. So it's the same expected from owners to the GCs to the subs. The more we get this information the better.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
A lot of the subs that we use are small contractors, a foreman may be doing one job, but they may be doing some other 3 or 4 jobs. At small projects, you don't have the same people every day. Which is a lot harder to communicate within the team? That's the biggest problem. The size of contractors because they don't have site specific supervision. And it changes. You can have one company with different guys in the huddle. When that happen nobody will commit because the other guys weren't there.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Yes, I'm familiar. One of our smaller jobs had difficulty to implement the whole thing. So I was able to broke parts of it. like daily huddles vs doing the boards and anything else.
16. In your experience, what are the main benefits of using the LPS?
Absolutely, we got to have buy-in from the entire team. It improves the overall flow of the project. it eliminates working around a bunch of material, you get stuff when you need it. eliminate rework. You can coordinate delivery. Have right people in the right place.
17. In your opinion, what are the main challenges of implementing the LPS?
Participation is the challenge. The moment we do with smaller subs, some of the PMs from the trade, you may not get buy-in from their office. It's really how the system satisfies our requirements to participate. But to me, that's the biggest thing, to get team buy-in.
18. In your experience, do you think the LPS is complicated?
I think is more a manpower thing. The trade dealing with their company, he is also the PM he is the estimator, so he is building all by himself, and if he has 5 different projects it takes a lot of their time.
19. Typically, do you think subcontractors really buy into the LPS?
There are a couple subs we use that, we have been doing this for a while, some superintendents use it better than others, but some others, where the pull plan meeting itself and get their input. But all they do is come to work. We still have to kick this in the smaller trades. He'll show up just to kind of see what we do and then do my work. These guys have been here at the morning huddle.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I don't know how to get the smaller guys into it. a lot of the bigger guys, they are, they see the benefit. It's worth for them, they can actually see it. some of the smaller guys have 15, 20 guys spread out in many jobs. I think even though the last project was implemented. Maybe getting involved in some projects where it was done right, so they can actually see the benefit. On the small jobs is hard.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

- All the time. but if you got the team and you do your huddles, you know what's coming and you can plan on it.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
You call everybody, and say, where are my guys? Just tell me what you need and we can work it out. If you need 6 days instead of 4 days, if you are short of men as long as we know about it, we can make adjustments. But you just can't pull everybody out here. and expect us to be supportive.
 23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Yes. Daily huddles and weekly updates and our look ahead we send, it helps everybody prepare for what's coming. You are not having surprises, they know what is coming ahead of time. I think the more information you get, with the milestones and everything else. They can plan around it.
 24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
There is nothing you can plan really. A lot of the things we are seeing, smaller guys don't commit. And if they have a choice to pull out guys. It's not much of being ready for, it's more to commitment. I think the more you plan, the better your job is prepared. The better your job is set up. The better chance you have to keep it. Because of number one, you got to make money. With all the lean tools. I would think better planning prevents it. But it still doesn't solve the small guy commitment. The only way is to get rid of that guy. If they don't want to buy into it, they can watch it from outside.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes. They cut out the work going on, through lack of participation. The accuracy of the information they gave us. It's happened.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
In this project, I don't think it was implemented properly to have many benefits. A lot of the material we were supposed to have it here only when needed. I think that has failed here.
27. Do you think the LPS was, or is, effectively carried out on this project?
In this project, I don't think it was implemented properly to have much benefit. A lot of the material we were supposed to have it here only when needed. I think that has failed here.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
More team support. It was a feel issue. That's worth stop it. Maybe more buy-in from some of the subs. More tempers on how to push it. More training. Somebody there as lean champion.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I think we would be the same as we are right now. Because as I said I think it was implemented improperly. This is not as standard as you can get. we have the boards. But they were not really coordinated really well. They were not really pushed. And this is from what I've seen during the last 6 weeks.

Interview #51

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my fourth project.

11. What is your understanding of LC culture and practices?
The idea to me is supposed to make work more efficient, less waste, fewer mistakes.
12. What are some of the benefits of implementing LC in projects?
I haven't seen them yet on this project, but the things I imagine, would be less rework, less last minute demands, it helps you look forward. I don't know that we have seen it realize here, but I have seen it in another project, and it's flowing very smoothly, we got to the point where each floor was turned over as we expected. We figure it out in the first levels what not to do.
13. What are some of the challenges of implementing LC in projects?
Buy-in from senior generation level guys, it seems younger people accept it better.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
I don't think so, with the old school guys we just trained them and they understood the benefits.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Starting at the end where you want to be, having all the steps that need you take you to get there.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
I think evidently if you don't start it from the beginning of your project, and you try to pull a milestone that is already behind, I don't know that you can get there. It's also hard to get people to get interested in it, sometimes they can't just spend the time. it's not just as effective.
18. In your experience, do you think the LPS is complicated?
I don't think so. If you can explain it, how it works, what it means, etc.
19. Typically, do you think subcontractors really buy into the LPS?
75/25 yes. earthwork vs utility contractors are so different. Like with MEP trades who are involved in the BIM modeling. With the coordination, I think it's easier for them. Depends on the trade.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I like to make it fun. We make a good job to make it fun. Especially when we do the implementation meeting. They don't want to dedicate 4 to 6 hrs. to sit there.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes, every morning.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
I called the PM and say send more guys, eventually, they send more, qualified or not. Labor is a problem on every project.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think it can prevent it, if it's used properly, not preventing at this moment. You can have a measurable, things you got if the guy is halfway where he is supposed to be. Maybe prevent is not the right word is more a catch.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Something we are not doing as effectively is including the manpower I the stickys. I think as we get getting out of the ground we'll get more detailed. If they are not telling you I will have 5 guys doing this work.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes, it did work and he got more people, we made the calls.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Since we got out of the mud, we meet every day, I would say they are really planning, ideally, you can make up some time, but only if what they are saying is actually real. It helps you find the constraints, to me they help you plan in advance to things you may need. It will improve the communication, once they are comfortable with speaking to one or another.
27. Do you think the LPS was, or is, effectively carried out on this project?
So far yes, we are continuously improving it.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I don't know, better detail from the beginning of our plan. I do think it wasn't entirely weather. When the guys started doing this, the information on the stickys is a lot better than when we started. So don't if we did ok. Get extra training or quicker transition from our previous system. sometimes is just really hard to keep some of the guys focused.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
We wouldn't have learned what not to do because it tells you what you need to focus on. how you will fix that. You had no idea how to fix them. How to prevent them on the next floor. There won't be learning curves. You don't have the opportunities to sit all together to find ways to do it. we do email the schedule, so everybody can review it, most of them reply is good to me, but that's not the guy on the field saying that won't happen. Accountability with judgment and punishment.

Interview #52

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
I participated in the last 5 to 10 years on projects.
11. What is your understanding of LC culture and practices?
Lean is trying to facilitate the schedule and everything, getting the subcontractors to buy into it and make it them part of it. Manage the construction process so we can streamline it, save as much time as we can.
12. What are some of the benefits of implementing LC in projects?
Basically getting the subs, the people on site buy into your whole schedule, making a team effort, collaboration.
13. What are some of the challenges of implementing LC in projects?
Basically, people saying they need more than they do. If they need 3, then they say they need 4 or 5, then you are not doing the lean.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
It depends on the subs, people they don't know it, they are getting to know it better, they are doing the whole process.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?

Yes, I know it.

16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
It depends on how sophisticated your subs are. This building has a little more, basically have a pull session for every room, because one room may ceramic tile, then the other may have a vinyl floor. So to do all the pull sessions is kind of complicated. There are times when we do it partially because it could be complicated.
18. In your experience, do you think the LPS is complicated?
I think as the subs do it more, the last planners get it done to the actual guys doing the work. But I think they make them part of them. It helps overall.
19. Typically, do you think subcontractors really buy into the LPS?
After they see the benefits, yeah.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
It's hard because you can have the same company or superintendent, and a lot of buy-in comes from a one to one, there are a lot of personalities.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Oh yeah.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
We try to get them on board, to do extra hours, more manpower, or find the problem, but more work for us.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think it helps for them to understand that his workflow, I think that if you are doing lean right, with the ups and down from labor, and usually if you get a sub with enough people every day, but it will stabilize and keep the workflow. It makes it harder to happen. And if that happens you are going to see it right away. If you have jobs that are going up and down. Saying, hey I need 20 people and then they say, next week I need 20. Hey, there is a problem.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
It's just managing them. Like I said, get a consistent workflow, everybody is doing, blow going, getting so much every day, they have a hard time pulling out because they need to meet their goal.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
We are not going to hit the same number from the first day, we ramp out. You have to get the flow.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
n/a
27. Do you think the LPS was, or is, effectively carried out on this project?
It's been carried out effectively, it's an overall project plan.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

I don't know what to say.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

I think it would be just a harder time to get subs to buy the schedule. You would have more resistance to doing their job because I'm telling them what to do. By letting them determine the order they want to do it, then they buy it. If you tell them what to do, they will blame you if something goes wrong.

Interview #53

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Es la primera vez que trabajo en algo así.
11. What is your understanding of LC culture and practices?
Yo creo es que tratan de poner todo en el pizarrón, para dares una idea de lo que va a futuro e ir viendo que es lo que va a pasar cada semana.
12. What are some of the benefits of implementing LC in projects?
Ahorita ya maso menos sé que es lo que viene para la otra semana, antes no sabía mucho de eso.
13. What are some of the challenges of implementing LC in projects?
Todo lo veo bien. Lo único es que es un meeting diario. Pero a la vez es a futuro es mejor.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
No entendía que era la idea, ya con algunas veces, ya empecé a entender de qué se trataba el Sistema.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, esta fácil.
19. Typically, do you think subcontractors really buy into the LPS?
Yo digo que estaría bien, que todos sepan que es lo que está pasando con cada trade. Yo digo que si necesitamos comprometernos. Para mi digo que si sirve.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Hacer un poco de esfuerzo, por los mismo foreman.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Si.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?

Como mi compañía tiene varios edificios, si yo estoy algo que no urge, me habla mi patrón y me dice necesito que me prestes 4 o 5 gentes. Así es como manejamos el Sistema. Hablo con el superintendente, me piden está gente y así lo manejamos.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

Yo creo que sí, así yo ya se maso menos lo que tenido a futuro y si mi patrón me habla, ya sé que no voy a poder prestar gente.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
No tengo idea. De repente hablan. Tratar de mantener la gente que te quito para que no te puedan quitar gente.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?

No, ahorita no.

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?

Ha beneficiado, porque aprendí como hacer el schedule y ver qué es lo que viene a futuro, que antes no hacía.

27. Do you think the LPS was, or is, effectively carried out on this project?

Si

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

Tal vez cuando subrayan las cosas, poner los nombres de las compañías y ahí cada quien guiarse en su línea. En vez de que estén todas desorganizadas. Los paneles lean.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

Estuviera un poco medio atrasado porque a veces no hay mucha comunicación. Con los superintendentes. Así ya sabes maso menos el schedule. Antes yo batallaba mucho.

Interview #54

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?

No, this is my first one.

11. What is your understanding of LC culture and practices?

Eliminate steps to make your work more efficient. And better quality of the job. By eliminating some of those steps. That could be eliminating paperwork. Eliminating those little steps will help you, you can go all digital to be more lean.

12. What are some of the benefits of implementing LC in projects?

It all goes back to the schedule, it helps you plan more efficient, more prepared, for unforeseen reasons, because when we look at planning, we look at every aspect, what if what if, etc.

13. What are some of the challenges of implementing LC in projects?

A lot of meetings, some of the subcontractors don't like them. So we have to push them to be here on time. Other than that, as soon as it starts, it will benefit the project.

14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?

We do subcontractor initial training, we all go on the table and tell everybody the expectations.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
n/a
19. Typically, do you think subcontractors really buy into the LPS?
After the training, they see the benefits and they like it.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
n/a

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes, it has happened.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
It's not very pleasant. Because the way we tell them, you have a contractual obligation here, when they pull and go to another project it falls on their responsibility.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
The subcontractors pull their activities on the wall. I think it prevents it in some way. I don't know. I can't think of an answer.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
It all comes to the preplanning with the subcontractor, giving them all the expectation to them and then you could prevent them by them doing the proper planning and preparing for the worst. Another way is we hire somebody else.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes, early on the project. With the shortage of the subcontractor. He brought that to the table and said that. We worked that with them. And helped us a lot. We don't want them to fail, we want to help everybody as we can.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Benefited, we all are really engaged. By using one sole system. We use this system with different tools. Here we are really organized. We are using a SharePoint, so everybody is aware of new documents, submittals, etc. Definitely has positive effects. These tools keep everybody focused on what they need to do, those meetings remind them what they need to focus.
27. Do you think the LPS was, or is, effectively carried out on this project?
It is for the most part, but there are too many meetings. That kind of goes where it is lean, because we are wasting too much time on that.

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Company wise we are still at the beginning of these new ideas, so we are trying to get adapted to. So we are doing a good job.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Delays, and delays in submittals, field. When I think about lean, I think about organization, so we are running lean to communicate each other. Would be chaotic.

Interview #55

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
It was fairly new to me. We have been doing it for about 2 years.
11. What is your understanding of LC culture and practices?
Try to work out all the, through scheduling all the meetings, just try to get rid of as much of waste as you can in there. Lean to me is a lot more coordination of the trades, a lot more communication in the field, where it gets done. And then gets rid of a lot of the I guess we used to be overlapping construction in gray areas in there, now you communicate enough to know exactly what everybody's doing. It's just to get more coordination.
12. What are some of the benefits of implementing LC in projects?
Coordination in the field is better. If you can get all the subs to buy in in the process to be more part of the morning meetings. And that's a bit of a challenge. Right now we do the huddles in the morning, some guys show up, some show up later, you don't get all the guys at the meeting.
13. What are some of the challenges of implementing LC in projects?
The biggest challenge is getting everybody used to it, it's a different method of construction from what we had 20 years ago.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
It's trying to get everybody to buy into it and get participation. It's just getting the daily participation from all subs.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
We have the tools that we use in the field.
16. In your experience, what are the main benefits of using the LPS?
It would benefit the whole team. The pull plan what I like about that is you get the buy-in from the PM and higher levels, and each of the subs too. With the pull planning we got foreman, superintendents, PM, sometimes they bring VP, so you are getting a buy-in from upper management, not just the guys from the field. Well, can you use some more guys? Well, sometimes depends on the PM. We need help them up. So it gives us a way to make them more responsible. Because they buy in.
17. In your opinion, what are the main challenges of implementing the LPS?
Smaller subs don't really see the benefit of it. They don't that proud to be in the project.
18. In your experience, do you think the LPS is complicated?
It's getting easier. The first one pull planning session was difficult, but the more you use something the more you get to benefit from it. The boards out here. Four projects that we are just to get done. As we go is getting easier, because we are not having to retrain. They say ok I already used it in another job, so they commit and know what is supposed to do. But it's always better that way.
19. Typically, do you think subcontractors really buy into the LPS?

Some of them are reluctant about it. A lot of the guys we typically use in other jobs, they do it because they know its required. That's the way we track it.

20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?

One thing that I've talked internally. When you start a job, maybe having a lean champion very familiar with the lean process, to come up for the first couple of meetings. Talk with all the team. For me, that's very valuable. So they can understand it more and give them a little bit of understanding why we do it, what it is, what the process is. If you can convince them, the benefits are it's going to save you time, it's going to solve a lot of issues. I think they will buy into it. Like an initial training.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

It happens all the time.

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?

You just start calling their office, you got this supposed to be done on this day, you had five guys, and now what happened? How are you going to make up the time? it's a lot of phone calls.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

With the pull plan and upper management being involved and buying in. You got a little more of information to go back to them and say hey you said you would, do it, make it happen.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

I don't think you would be able to avoid this. A lot of subs have very different jobs going on. its whatever prioritized.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?

Yes. Usually email to their PM, phone call, talking to the foreman. Usually is just a set. It's always excuses. But then you still have to make sure they know they are responsible for getting to that date. Because that's part of the process, everybody is talking back and forth. What every trade is going to do. So you got it all on the boards. So that's a responsibility that you can hold from the trades. You got this.

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?

If they have benefited. With the pull plan, daily meetings. It keeps everybody to keep on back to a responsibility. Everybody realizes what their promises are, and how they are committed to their commitments.

27. Do you think the LPS was, or is, effectively carried out on this project?

It could have been done better, but I'm getting used to it.

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

When we first started I wasn't religious doing the daily huddles. So getting them from the very beginning, would probably get the best results.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

I don't think we would be near far along where we are. Behind schedule. With people arguing all the time. now that we go to the end. We have trades on top of all of them. The process allows you to schedule it so much better, that you allow some of those conflicts.

Interview #56

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?

In the 90s we were involved as GC with a movement called total quality construction, I feel is a lot like the same principles. It was a lot of the Toyota principles. So we started there. It was more just to the improvement process. and continually looking at improvement. As far as some of the lean concepts that we are using today. Like LPS, pull planning, that's relatively new to us. I guess a few years ago we identified to our strategic planning and we meet with several contractors so we can make a better partnership with them. The best thing we heard that's what we needed to be the scheduling company. Because that's what they make money. How can they maximize their manpower flow between projects? Not a big deal in big projects, with dedicated teams. But on small projects it is something. With better productivity in schedules, they can offer us cheaper prices and choose us between contractors. I had enough knowledge about lean, so that's why we implemented it.

11. What is your understanding of LC culture and practices?

For us is bringing transparency in the whole process. Being to work in the denominator in the field. Know the process to get on goals. Everybody is on the same page communicating. To me is a communication tool. It's a way to keep everybody on the same page in the same direction and accountable to each other.

12. What are some of the benefits of implementing LC in projects?

We can do projects quickly, we save money, we save subs money because they can be better scheduler. If we can make more money. If our jobs are more profitable, they will want to work for us. In the current industry is a big benefit, because they have to make big decisions in regards to work for whom, there is so much work out there.

13. What are some of the challenges of implementing LC in projects?

Getting buy-in among all the trades. Because you can have 90% of the subs in the process, and then the 10% can derail it. So someone has to be in charge of that, getting the participation of all of them. As part of our subcontractors' lecture process.

14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?

It's probably the whole process. we see trades go through the process several times, they understand the benefits. And even the foreman understanding is bringing those subs to the first couple jobs. You have one crew from a sub for this job, then you go the next job and put a different crew on it. if we can have some consistency in crews it would greatly benefit the process.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?

n/a

16. In your experience, what are the main benefits of using the LPS?

n/a

17. In your opinion, what are the main challenges of implementing the LPS?

It's training, getting everyone. A lot people the support they need and the buy in. I think it's easy to build the tools and make the map, and give the training, but when they are in the heat of that battle, having the confidence in the tools rather going back to how they did things before. You go

back to what's comfortable. They are not comfortable with lean yet. Superintendents report its beneficial. But a lot of them go back to what's comfortable. Because they have done things for 30 years and then change that to a year.

18. In your experience, do you think the LPS is complicated?
In the end, once they learn it. Simplifies things. Drastically make things easier if they are fully embraced. It keeps everybody on the same page. If you rely on the system, that's a benefit of it.
19. Typically, do you think subcontractors really buy into the LPS?
I think that's the hard part. You just have to really force them or lead them through the initial process. a lot of our subs have a lot of experience. But there are always 2 or 3 on each job that's new to them. You just have to have the people around and telling them. If they trust it, they will see the benefit. Kind of getting their initial buy in, their bosses for the huddles. Being present even if they don't have men on site. It's a buy in, then I'll see that extra time will benefit in productivity settings on the road.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
n/a

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
The same way, the lean system gives us a tool. Because hopefully, we have a commitment from them. When they are not doing it, we can show them, not only the contract but their commitment to the other team players that go behind them. Otherwise, we would put them on notice. Taking their actions. Generally, a little bit of threat. But I think the lean system gives you another tool in the process to really convince them to keep the manpower and commitments.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think it does help, it helps prevent it in some way. I need you to get an extra work. I think there is commitment they are making as team members. It's not what they have to do, is their feeling to the other guys in the team, to pull their own commitment.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
I don't know that there is anything more we can go through the last planner system. we have talked about contractual ways to do it. Making sure that they are negotiating faces or if they are committing too many resources to the job. I don't know how we can do with the LPS. I think we've seen the benefits so far from it.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Absolutely benefit. Affecting their ways of behaving. Before we found that you could go on a project and ask a random foreman, what's the next milestone date, what's the next target, they

- wouldn't have a clue. Otherwise, they will go after and install whatever. Do they have any idea of the goal of the project? have everybody concentrated on the same goals.
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
 28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
The frequency of the huddles. If they do it daily, that's a huge advantage. Our estimation is that that's the key of this system. everybody is coordinated and working in the right direction. Increases communication. Make sure there is a frequency of a daily huddle.
 29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I would like to think we always did a good job. They are doing it for 20 years before we started on it. I just think that you could always do, but there is always ending in a lot of stress, a lot of extra work. I think it simplifies the process and makes it, less stressful. The guys doing the work less stressed out they can understand it and keep it. if we use traditional methods more stressful. We may not have this guarantee target of completion dates. Our completion is more predictable that we used to be. We were able to identify early on, where we are going to have a problem.

Interview #57

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
First project.
11. What is your understanding of LC culture and practices?
How finding ways to add value to a project. If I have to just to think about it.
12. What are some of the benefits of implementing LC in projects?
I find that one big benefit is I get quick responses, accurate responses. The last planner has an opportunity to setting to tone for the completion of the project. Opposed to someone a dictating corporate office. These guys here know what needs to be done. It just allows then to participate. It creates Value when it comes to production. It provides you a cleaner site. And a safe one.
13. What are some of the challenges of implementing LC in projects?
Getting people to really believe that it works. And send them now. That takes from start to finish. It took me about 3 months to get people really on board, and that was after consistently telling people you got to do this and that. That's a challenge because it's mutual and they didn't have to sit here in the daily huddles. They could sit here because they have to. But now they can see in those meetings whatever they need to do during the day. Everybody should be cautious about all the constraints. Everybody knows what got to happen. You know you got to have a fitting. So we have an opportunity to talk about it, just briefly in the morning. Is usually enough.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
I think it goes back to corporate level. Getting all stakeholders. You know to say hey guys, this is how we are going to do this job. Their project manual should include it. People in the staff need to see the value. That would make us easier.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a

18. In your experience, do you think the LPS is complicated?
No, it's a very simple tool. I think after one of the subs coming here for 2 mornings he's got it. he understands the project more. If it just comes down to a site. And he knows anything about this job. That morning he will know everything about the job. He will know what expected that day, for every trade.
19. Typically, do you think subcontractors really buy into the LPS?
Yes, after a while. There may be somethings and lean don't work for them. Because of personalities. As long as the human principle stays, he is going to be very successful.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I wouldn't change anything, I would add more. I would put more activities. To have more info on the boards. More line items and company name on the boards.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Each scenario is different. For example, one trade comes to me and say, I'd love to keep going, but I have 12 projects, I need to pull off for a minute. Now I got to have a way to figure it out to work with him. He goes and that's what he is doing know. I scheduled it, and I represented him on the lean board, I know when they will be installing their work. That's how usually I handle it. We figure it out.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think it's there. I don't think it needs to be prevented, number one because it always exists. There is going to be companies that a lot of things going around. That's what the prerequisite came in hand. I know before he can finish up. My prerequisite is they need to do this activity. It doesn't prevent it, however, it helps manage it. Because it gave me what the manpower needs to be for the activity. If they have a problem with this job. And they kick their issues. It's one of the best tools to use to prevent it. Because you control manpower on the boards. And last planners can call their office to get more manpower.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
It's a management constraint. If they have a problem with getting that manpower. We can put that over here. and say where are you going. It's a matter of the last planner. He is responsible. I've used this for the owner. My owners know that quickly.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes, first I talk to their superintendent. They get manpower. If that doesn't happen, you have to escalate it. After that, if out of the lean board's control. And then we try to get back on track.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I think it has benefited the project. just looking at from a superintendent's perspective. I know every morning. I'm engaged with each and every superintendent on this job. Every morning. No one is

- your plan changing. Because before the end. They would change the plan and they wouldn't know. Everybody is engaged and knows the project.
27. Do you think the LPS was, or is, effectively carried out on this project?
It can be better. I got to learn how to pull back. And may be in the learning process for me to pull back fast. While we teach it, I find it necessary to do it this way, until now I can cut it.
 28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I don't see anything wrong with it.
 29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I would be behind schedule. Using that lean board on daily huddles, help me keep on top of the milestone. Trying to get to that.

Interview #58

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Yes, in another project.
11. What is your understanding of LC culture and practices?
Is that it helps to essentially eliminate the problems and make everyone work together as one, vs each sub coming separately. We all are working together.
12. What are some of the benefits of implementing LC in projects?
A lot of water moving pieces. So the fact of having the daily huddles which are the biggest benefit of lean construction, so just that everyone is on the same page. In my other project we had several projects at the same time, so in the huddles we tried to make sure there was no conflict between projects. Here is being very helpful as well. Those huddles are extremely helpful. When you get everyone talking what they will talk, gets people thinking about the project. they come and talk to each other and subs. And say oh why you do that. Just help get everyone to know each other.
13. What are some of the challenges of implementing LC in projects?
With the newer subs or smaller subs, who have never deal with this. After they learn and understand it. We had several subs coming and say oh wow. Communicate before we hit the issue. People has never done it before. Or in smaller projects, the benefits are really needed. In the whole lean process.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Getting everyone on board, betting the subs to really do the process, turning the weekly plan every week, even if they did it before, they don't want to do extra work. Getting the participation going. They enjoy the daily huddles.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Probably.
16. In your experience, what are the main benefits of using the LPS?
Honestly, I don't think I ever saw too many differences. Not what we didn't use a lot of them. If we didn't it to the extent that we are doing here. I'm still looking at the same stuff. We are very lucky to have very good subs. They understand the process. I don't see too many differences.
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
I don't think it's complicated, I think it's self-explanatory. Tell me how you will do this. I don't know. It's hard for them to really nail down in this section, and actually performing that. Is it

probably really what they are doing? It is much repetitive. They finally learn to fill it up properly. I think they are still working on that here. there are so many moving pieces. It's hard for them because it's very specific. So that part is too detailed sometimes. If you sit down and understand what you're doing. So you are planning ahead.

19. Typically, do you think subcontractors really buy into the LPS?

I think so. I think they are starting more and more. Before we didn't use the full system. I have been doing it for 6 years. But the weekly meetings and I would collect and calculate. To be able to have that benefit. In this project, if that's done floor by floor. You can work in a fast way. If there is an extremely. I always think it's real.

20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?

Showing them how much it benefits them. We almost make the buy into, I feel in the contract process, we tell them about the daily huddles and all that kind of stuff. Explaining how it works. More training.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

I don't think I have, I know people who have.

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?

You call management if they are pulling people out of the job. Say this is not acceptable. This isn't in your contract and kind of stuff. In case something externally is happening.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

I guess I can see where it can help to not get people pulled off because you are planning upcoming work, I see the benefits of making that not to happen. Sometimes they just pull people a couple days. But I can see lean helping in preplanning the work. I see the benefits of it.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

That's a hard one. I don't know how you really can handle that, other doing what we do, calling management. Or you threat them. Situations like that.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?

Kind of. Not that they are pulling people from other places. They are not just getting the job properly. We usually push them.

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?

n/a

27. Do you think the LPS was, or is, effectively carried out on this project?

Yeah, I think it's being great. Get the subs to make better weekly work plans. We do the huddles and pull planning sessions fine. Sometimes they don't fill them the best way. Because it's making them thinking different. Projecting out, what they really need to do. So that's all accurately. The weekly work plans.

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

Maybe the massiveness of the 6 weeks look ahead, how long it is. It's hard to focus on it. Because there are so many different things. So many factors. It's hard to kind of really have people look at that. Not that they can't understand it. It's just pushing it off. It's a good tool if people use it in the right way. I don't know how to simplify it. Because is so large. Maybe training the subs better in the weekly work plans. Being harsher if they don't it properly.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

You will never meet the schedule, you will have many conflicts on the field. A lot more fires to control. A lot more issues. And communication I don't think it would be very well. I think that's one positive of lean, people try to communicate. The best thing of lean is the daily huddles.

Interview #59

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my first lean project.
11. What is your understanding of LC culture and practices?
Organizar el trabajo, de todas los trades, organizando todo eso para que el trabajo vaya Adelante.
12. What are some of the benefits of implementing LC in projects?
Coordinar la gente para trabajar.
13. What are some of the challenges of implementing LC in projects?
No veo.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Hasta ahorita no.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No.
19. Typically, do you think subcontractors really buy into the LPS?
Si.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Hasta ahorita no.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Si
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Eso se hace usualmente con fines de semana que no se trabaja aquí, reubicar gente en otros trabajos para avanzar la producción en otro lado.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
n/a
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Hasta ahorita lo que hemos hecho aquí nosotros es como reubicar gente, pero viendo el no retrasar el Proyecto de aquí. O sea, viendo adelantar un poquito aquí y no reubicar esto más.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Hasta ahorita no.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Han beneficiado.
27. Do you think the LPS was, or is, effectively carried out on this project?
Se está implementado bien.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Hasta ahorita no veo que cambiar, se ve todo bien.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Mucha desorganización.

Interview #60

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my first project.
11. What is your understanding of LC culture and practices?
I think it's just really to keep everybody on the same page. That everybody works. It's to constraint handle. Better flow. You have to always be able to work together, it's good to walk in and see it, to know who is where and who is doing what. It benefits to us.
12. What are some of the benefits of implementing LC in projects?
Just keeping all the trades up to date on what's going on. a
13. What are some of the challenges of implementing LC in projects?
Not really.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Scheduling is probably the highest problem. If you plan for 3 weeks, it's though, everybody is busy, so you may have 7 guys one week, then the next one only 4, so the constant fluctuation is the biggest challenge.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a

17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
I don't think so.
19. Typically, do you think subcontractors really buy into the LPS?
I think for the most they do.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I think If we went every other day on the huddle meetings instead of every morning because everybody is so busy. So I think If we do the huddle meeting 3 times a week it would be a lot better.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
No
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
n/a
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I don't think so, I don't think there is anything that will prevent it.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Proper planning, but you still can't stop those guys to go somewhere else. It's real, what are you going to do?

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Benefited. It's useful.
27. Do you think the LPS was, or is, effectively carried out on this project?
Yeah. They have done a good job.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I really don't have anything to compare it.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
A lot of issues on people working in the same areas, having all the foreman and sitting there and discussing what areas they will work on is a huge benefit.

Interview #61

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?

Roughly the past 4 years of projects. In some type of projects, they like lean because of the tight schedule.

11. What is your understanding of LC culture and practices?
Lean is essential to certain projects because they have to pull tight schedules.
12. What are some of the benefits of implementing LC in projects?
It's accountability, it's being there when it's needed. If he says it's going to be on Tuesday, then it should be that day. They also know where are they going to be there on a certain day.
13. What are some of the challenges of implementing LC in projects?
It's knowing what you're going to do, and when. Sometimes when you don't do something that's not appropriate. Challenges are not having all of the people. When people have done a lot of it, he doesn't know where is it going to take, how many guys. Is just you try to get more and more. Also with that being said, you can be experienced. But your expertise can be diminished, you don't always have the same guys. If they pull them out to different projects at the same time.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
It's getting people the buy in. Not everyone supports it. Are there more teams doing this? If you have that people.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
I think I received training about it. Usually, they use one week and six weeks look ahead.
16. In your experience, what are the main benefits of using the LPS?
I see good things in this project. The constraints are a good one. Also, deliveries are a good one. If we all get deliveries at the same time. It would be a mess. It prevents us to stacking all that material in one area. I see working extremely well.
17. In your opinion, what are the main challenges of implementing the LPS?
The only think is that in this project, not everybody bought into it early enough. Because it's something different, if they have been working in the construction for 20 to 30 years, is hard to accept changes. You get a routine.
18. In your experience, do you think the LPS is complicated?
It is. It can be overwhelming. On achieving all of the information.
19. Typically, do you think subcontractors really buy into the LPS?
Mixed.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
It has to be done per company. Every company has to train their own guys, so they can see the benefit of it. so they can make this more profitable. They have to invest in their people. To make it work better. It may take classes.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
I have. Just get on the phone. To understand where we are. We don't have that time availability. To get behind. There is no reason one to get this job behind.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
I make the call. Obviously, send them messages. To their bosses. If they don't pay attention. I'll call my boss. And we make it happen.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think the lean does help things to prevent that from happening. Because you know in a week from now, your commitments. You know that's going to take for a week. So it captures it. there is no way to prevent it. I think all companies have been there and if they need to pull resources they will do it. it also helps it to prevent it.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Pull, call ten companies, there are some pretty decent sometimes, and help them with the slack. You just have to have that ratio.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes. if the project is behind, you do what you can. Call my office. We were behind, it puts more pressure on everybody. I don't like to fail. I like always make money. It just made us fall behind. Also quality tends to go down, we have to do rework due to quality.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I think benefited. Let's meet and plan for my manpower, and where to enter in that area. When you got one or two guys who don't buy it, that's when it hurts.
27. Do you think the LPS was, or is, effectively carried out on this project?
It could be more effective. I was kind of. I guess they were trying to figure it out how to do it. hat kind ran people a little crazy for a while.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Encourage all people to attend to the daily huddles. we haven't been able to be part of those meetings kind of hurt.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I think it would be in a worse place. The dates would have been pushed out further.

Interview #62

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is the first lean project, that we really experience it.
11. What is your understanding of LC culture and practices?
Since this is our first experience, the way they bring everybody together, it has worked out extreme well, to manage all the technical stuff, knowing what's going on is a good understanding.
12. What are some of the benefits of implementing LC in projects?
We all are able to input our data on the schedule, but it also sees what the other trades are doing, to we can sit there and build the schedule together. Everybody is more accountable.
13. What are some of the challenges of implementing LC in projects?
I haven't seen many challenges, it has worked well for a while, working with all trades, so there weren't many challenges.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
We didn't experience any issues with it. Even when that was our first time. We sat down and it was a good experience.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Not really
16. In your experience, what are the main benefits of using the LPS?
I think combining it, using all the LPS tools, I think they all are beneficial parts.
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No sir, it is very simple.
19. Typically, do you think subcontractors really buy into the LPS?
Some of them may have some experience with it, working with this job and the scope and size, the attitudes they had has worked extreme well, I would hope that they could be open to it, so they can see the benefits of it.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I don't any opinion about what would help them to buy in, except to experience it. They can organize it and make everybody follow the line. The benefits to plan this. Just get them to try it out. They will see the opportunities they have.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yeah, we have been in those situations and depends on what other trades are doing, it kinds of dictates that.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Technically we just look at the manpower, and where they are in multiple jobs, so we determine which is the best way to relocate them. We try to balance them.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think it's definitely, it helps to alleviate it, it's a big team effort, because if one contractor is in issues, then those drive it to fall behind and then they have to put more manpower to get back on track.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
We are more, there is a lot of unforeseen with other contractors, weather may affect, it works only if the contractors are implementing it. So they can plan. Each contractor during what a lot of the time, we can all spend time in the schedule if one link is behind, then everybody will get delayed, so that's a big thing.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Definitely, with some of the ground and utilities going, there was a deviation from the schedule, definitely that issue affected. We just try to move as fast as possible to make up some days, we just try to take out some days to alleviate the delay.

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Benefited the project, with the size and scope of it. Without it, we would not end up with the actual scope, previously with the schedule done, everybody knows what everybody is doing. What we need to do every week.
27. Do you think the LPS was, or is, effectively carried out on this project?
Yeah, it was carried out very well.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I don't know that I would change anything, this is our first time, once we did our first pull plan we started to work on it. I guess better education, as the second pull we were maybe better in understanding. But we figured it out.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
It would have been time, the schedule would have taken longer to build it, to where we are right now, it would mean more dollars, more man-hours.

Interview #63

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
1.
11. What is your understanding of LC culture and practices?
That is just a way of organization. It's like organizing the site as a whole. All project is organized with lean system. from my understanding is more scheduling. Making sure the job being done correctly as far as conversation wise, we had a chance to discuss it as a team instead of individual speaking to one subcontractor. So it's a way to organize with this lean. All other projects I've been on, is where no one has been organizing. That's what I've seen.
12. What are some of the benefits of implementing LC in projects?
As far as seen how your productivity has done for the last week, that you can keep it under your arm. You can see what you accomplished. It's a more visible way of building it. I see a lot of advantages. You don't have to guess or folder something. And this is on my second week working with this lean system. but I have not done the totality of what lean is.
13. What are some of the challenges of implementing LC in projects?
With the subcontractors it may be a language barrier. I haven't seen too many disadvantages. It gives the company doing the lean system, to know how many employees he has on site. I don't see any kind of seriously disadvantages.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
I think it's too early for me to give an opinion.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
n/a
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?

I don't see it being complicated, it kind of simplifies it. Everybody gets on the same page. Everybody knows what the other sub is doing. So there is no question about it. you may deliver this project faster, it really is.

19. Typically, do you think subcontractors really buy into the LPS?

I can't say they do buy into it. I don't know if subcontractors and construction workers are unique in their own way. Ones it's set, a way of doing things, that's how you usually see things better. You know they can have a choice, but the process as a whole is fine. What I noticed is when the huddles we have for this process. they have to stop what they are doing.

20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?

One suggestion is to do the daily huddles first thing in the morning. So they don't need to stop their activities. I like the fact they do it first thing in the morning. Before it gets too late.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

Yes

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?

You can stop them. You need to make sure these guys get compromised. If this building is not building, then they won't get the job, they need to bring more people. They don't have enough manpower. What the schedule requires. You can't pull people.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

I don't think it prevents this issue. Their manpower, I don't see how this really controlled by the lean process.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

I don't know. I don't think there is a way around it. the only thing they could really do is have more preplan.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?

Yes. The subcontractor made a call to get more people. I do believe they actually want to charge the general contractor for the extra hours.

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?

Yes, new people on board gets adapted and up to date on the project.

27. Do you think the LPS was, or is, effectively carried out on this project?

n/a

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

Lean has helped me adapted to this facility quite fast. By doing this process that I'm looking at the wall. I really don't see anything that I would take from. At this moment.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

n/a

Interview #64

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
No, this is my first lean project.
11. What is your understanding of LC culture and practices?
I have participated in another kind of lean projects, on which we use standard company policies that are using lean principles.
12. What are some of the benefits of implementing LC in projects?
Those practices like keeping everything organized and working collaboratively with subcontractors is lean. It helps when you are able to get the subs to get in and out without problems.
13. What are some of the challenges of implementing LC in projects?
In our city, our subcontractors are slightly behind other cities. They tend to push back. We usually do onboarding with them. When people come with us they understand what we expect from them as far as lean and everything. At first, we had a lot of pushback from the subs, but I think with time, they realized the benefits that come from. And everybody at least in this city is starting to flow.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
I believe sometimes is just getting started. Getting that first step going is very difficult. Definitely, we need somebody from upper management, willing to push it forward. You have to set that standard on the project and keep it all over. If you start high, it makes everybody's expectations of what's required. I definitely think that's one of the main things that we need to start from the beginning.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
We have look heads, and everybody has a plan, a time and place on where they will be doing something. So we bring everything, so everybody is expecting to perform as far as materials and all that. We don't bring them in until we need them. Instead of having stockpiles around that.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
Just at the beginning. Now that everybody has the idea of what to expect, it's not complicated.
19. Typically, do you think subcontractors really buy into the LPS?
A little bit, if it's their first time, it's a learning curve, but it's not too difficult that someone can grasp it. You just got to get used to. Getting them to buy it, you have to be able to show them that it works. You should be consistent, and standardize procedures, otherwise you won't get the best results.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
We got to get them to believe it works.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes.

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Usually our subs they don't tell us the truth when they have a short. I personally take big track of that. I know when somebody doesn't show as supposed, I track schedules a lot. I just get on the phone right away, to push. Once you get into that is just whoever barks louder.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Honestly, I don't have anything for that. The only thing is just again constant communication. Email is an important tool for making something formal.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Maybe if you do man hours' allocation in your pull planning session. I guess make sure to do that in the pull planning session. So subs know how many men are required.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Benefited. Because we have been pushing it. When I got here, it was very well organized. So on this project just the way they stack the material in order.
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
n/a
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
n/a

Interview #65

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Este es mi primero.
11. What is your understanding of LC culture and practices?
A lo que entiendo es que ellos tratan de poner fechas para tu trabajo, verdad, pero si tú dices ok, por decir este trabajo, tu traes 15 gentes, ellos te piden para acabar eso, te cuentan cuantas gentes, si pones 6 gentes ahí, pero tú grupo es de 15, te dicen, necesito esta otra pared, cuanta gente vas a meter, meto 2, se va recortando la gente, otro trabajo 4, Bueno ya no tienes gente y te siguen pidiendo. Pero no terminas un trabajo cuando ya te están poniendo otro. Yo pienso que eso es hacer el sketch del trabajo y después pídemelo otro trabajo, si me pides en otra área al mismo tiempo, en el pizarrón, no se puede hacer así.
12. What are some of the benefits of implementing LC in projects?
No hay beneficios, ya vienen siendo retos.
13. What are some of the challenges of implementing LC in projects?
Los retos, son por decir de esta pared exterior, te marca tantos días, ya tienes tú que decir en estos días tengo que acabarlo, tienes 2 semanas, no sabes si lo terminas o no. Por decir en esta área me habían dado 4 semanas para acabarlo, pero vieron que empecé bien, y me recortan a una semana,

es imposible. Lo que hago yo, me regreso, ahí me checan ustedes y al día siguiente me piden 2, menos, pero yo ya te había dicho, es lo Bueno ya le habías puesto 4 semanas. Es lo que yo veo bien.

14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?

Tengo que ver cómo le hago para hacerlo con la gente que traigo o no, cumplir lo que ellos piden.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?

n/a

16. In your experience, what are the main benefits of using the LPS?

n/a

17. In your opinion, what are the main challenges of implementing the LPS?

n/a

18. In your experience, do you think the LPS is complicated?

Digamos que sí.

19. Typically, do you think subcontractors really buy into the LPS?

No creo. Porque es muy difícil, nosotros trabajamos por tiempo, yo tengo en mi tiempo me dicen, tú tienes instalar esta actividad 200 horas con tantas gentes, para esta actividad tienes tantas horas. Desde mi oficina ya viene el plan, de cuánto tiempo yo gasto en cada actividad.

20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?

No tengo idea. Para que no sea cansado es que no se haga todos los días. Que se reduzca a dos veces a la semana. Sería mejor. Porque gente anda por decir, los supervisores, y contratistas, todos tenemos que trabajar, desde que llegas tienes que estar pegado con la gente. Pero sí todos los días te quitan 30min o 45min, estás haciendo algo que tienes que pararlo, porque tienes que ir a la junta.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

Todos los días.

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?

Tenemos muchos supervisores, pero algunos son de un área y otros de otra. Nosotros tenemos un jefe para cada área. Yo cuando me falta gente, hablo y vendo que trabajos se van pasando. Y la gente que me Mandan a mí, la gente está dando vueltas en todos los proyectos. Nivelamos manpower entre proyectos.

23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?

No, claro que afectan. En este trabajo, depende de no sé qué tanto tiempo. Pero sí está atrasado el trabajo si afecta. No si lo previene, al hacer el sketch de la semana, ya tú tienes que estar asegurado en cuanta gente tienes que tener aquí. Tienes que tener, si ya dijiste, me tardo tanto, tanta gente aquí y allá. Esa gente no se puede mover de aquí. Lo puedes prever porque ya tienes tú, tú plan de trabajo, de la semana. Es cómo lo puedes prever. Viendo que tienes que tener tanta gente en el trabajo.

24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

Ideas no.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No, me está pasando que me falta que 4 gentes no vinieron, pero uno no puede disponer de ellos. La vida personal es diferente al trabajo. Uno trata de qué cuando estén aquí, pero si no vienen no puedes hacer otra cosa. Yo hablo a la oficina cuando faltan una vez la gente, no les hago tanto no les digo nada, por cosas personales. Pero si faltan 2 o 3 veces a la semana. Hablo a la oficina, y ellos me Mandan otra gente y hablo con ellos y muchos dicen que está muy lejos. Ok, déjame tratar de reubicarte en otro trabajo.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Si ha ayudado, por lo que te digo, y te haces un reto de lo que estás haciendo. Si ya dijiste en una semana termino este trabajo con tantas gentes, eso es lo que ayuda a la constructora. No nos ayuda directamente a nosotros porque es más presión. Y si no traes suficiente gente, en eso afecta.
27. Do you think the LPS was, or is, effectively carried out on this project?
Está bien usado, nomás que yo te puedo mostrar en el plano, como yo he trabajado en diferentes compañías, en el plano te marca las diferentes áreas. En otros trabajos se dice vamos a trabajar en esta área, y se puede usar para hacer lo que es esa área, verdad. Si se divide el Proyecto por áreas, es cómo está marcado en el plano, pero estas trabajando todas las áreas al mismo tiempo y no puede ser así.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
n/a
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Para mi estuviera, dentro de lo que hago igual. O a lo mejor algo mejor, porque uno ya trabajaría por áreas, así como te menciono en el plano. Más cómodo. No dejaría áreas a medias.

Interview #66

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Total 7 projects.
11. What is your understanding of LC culture and practices?
Several contractors that we work with they use it. streamline the process and try to save time, where you can save time in coordination. Hey, this is what we are trying to do.
12. What are some of the benefits of implementing LC in projects?
Previously I had a situation where you may meet only once a week as a group. The lean helps with the daily huddles to work out the coordination. The one thing when you spend more time with the people running the project you build more personal relationships that kind of moves differences. If you are strangers is a lot harder to coordinate work together.
13. What are some of the challenges of implementing LC in projects?
Time management. It does require some time as far as direct supervision. The time you have to spend here coordinating you are not directly overseeing what's going on out there. Sometimes there is conflict about that. But that's really the only negative that I can think of.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Most people are not receptive to change, industry-wide. Only 20% to 30% contractors that we work with are implementing it. So far, it's growing. it's the future there is no way around. Until all the smaller contractors see the results, the incentive they won't be reluctant to change. Then you will make more money. If no one in my company cares, then I won't care that much.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Yes, we are using the boards.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
You meet day by day, with people trying to change direction every day. If you don't have somebody guiding the whole project. if you have that person there, it works, otherwise, if you change direction every day you will lose a lot of time on the project.
18. In your experience, do you think the LPS is complicated?
I don't use all the tools, so it doesn't seem complicated, it seems simple to me. But I don't always have that. I got the big picture. But for somebody with all the trades together, to me is simple as far as tracking progress and planning.
19. Typically, do you think subcontractors really buy into the LPS?
Right now, I don't. I like to come to go to the daily huddle. The biggest problem is getting everyone to agree on a plan and then stick to it.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
If everyone buys it, it works, but if no one has been exposed to a training it's hard to get them to buy in. Even though this company is committed, but very few of other subs have an idea of what's going on. So at every project they got to explain, ok this is what we are doing. The superintendent needs to encourage the subs to buy in. Make it a requirement in the contract.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
I haven't just because the people under us, we just don't subcontract that much. They usually are very responsible. But I've been in contractors and that happened to ourselves.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
In this situation I don't have the manpower that I need for this project, so in order to try to meet the schedule for the project, if I need more guys, I make them work more hours. To try to recover the delay. However, it's not sustainable in the long term.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think they probably help in most cases just because you look at 3 weeks ahead. It would be rare for the situation that came up when somebody says I got another project, and I didn't know I had to have people here. I don't know that it prevents it, I don't see how it prevents it. To me it's information, so if the individual subcontractor participating in some other thing. Then maybe share a schedule, this is just time. you can plan all you want, but it's along with the individuals.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
I don't know you would have this, without having some kind of. If you don't meet what you say, then we are going to take this action against you.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I think it has benefited it. What I've seen is that you can get a lot tighter schedule, it's not somebody saying, oh I think I'll take 3 weeks here, that won't allow you to do it. It pushes you to schedule much closer.
27. Do you think the LPS was, or is, effectively carried out on this project?
I think so. It's still being implemented, so there are a lot of contractors who have never done it. the more you do it, the easier it is.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I don't know that I would change anything, maybe a requirement for everyone to get a training. Not extensive, but just maybe the basics. this is what we are trying to get. It would help to get the people reluctant, to go ahead and do it. For the good reasons and money in it.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
You will not meet your deadlines. I've seen many projects where the subcontractors kind of ruin everything. And just with the daily coordination is really hard to schedule anything and it holds all people accountable.

Interview #67

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
To an extent, three with this project.
11. What is your understanding of LC culture and practices?
Is a process, on how you can plan and coordinate the work. The best way to do it, with the least amount of waste. Try to improve the overall process.
12. What are some of the benefits of implementing LC in projects?
If you get everybody involved early on, the communication of working with everybody together. Try to work together to came up with the best plan or sequence of work.
13. What are some of the challenges of implementing LC in projects?
A lot still getting everybody buy into the system. probably more with the least qualified foreman, language barrier.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Most everybody was willing and engaged, the last project I had people that didn't want to do it, in this project people is more engaged.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Getting everybody to start from the end, and planning to minimize the duration of your project.
16. In your experience, what are the main benefits of using the LPS?
A lot depends on the project if you implement it correctly. This time we started early on, with the complete process. in the other project we just tried to use what could use. Try to get more focus on the daily/weekly plans.
17. In your opinion, what are the main challenges of implementing the LPS?
n/a

18. In your experience, do you think the LPS is complicated?
No really. It comes down is pretty straight forward, I know it takes a little time for them to understand it. I think after a couple of weeks they understand it.
19. Typically, do you think subcontractors really buy into the LPS?
I think some of them do more than others. I would say 75/25, they don't really want to be engaged.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
We started early on, we brought the contractors to bring their PM and foreman, but at that time, only the PM and superintendent attended, so the guys actually doing the work didn't attend. So it's important to have those guys.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Usually is a conversation, to understand how they can accomplish, to our team this is our most important project. trying to get them focus on that. It's always struggling with that. If they have a couple of little projects.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
It could if they really buy into and commit to what they are supposed to be committed. Because it's basically enforcing them to put their name on the board saying I will complete this by this date. At least it makes them sure to understand what they need to do and the consequences.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
No, is still communication. On this particular case, there was another job, that we had to split people from. If you communicate with each other, hey I need to take this somewhere else.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I think they have affected it, in having people more engaged, they see what is going on on a daily basis, what is going on, and their relationship with the next guy. That is something they don't understand if they don't talk about it. What the other trades are doing around it.
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
We had a little big error, we couldn't find space for meetings. So people is tight here. so anticipate enough space for these meetings.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

The potential to not keep on track the schedule. Rained affected here. Vs traditional procedures we just would have been updating the schedule. With different things happening. more true information.

Interview #68

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
A total of 3 projects with this one.
11. What is your understanding of LC culture and practices?
To me is efficiency. The word that comes to my mind.
12. What are some of the benefits of implementing LC in projects?
A perfect example is this project. We started and had a bunch of rain, and unforeseen conditions which contributed to more days of delays. We were behind schedule. We were able to pull the job back again, after pull planning sessions and make up that time. We are currently running on schedule. So we couldn't have done that without lean practices. Without the real participation of the contractors, and collaborating. And all those parts to find that path.
13. What are some of the challenges of implementing LC in projects?
Participation. Getting everyone on board. We are lucky here because we had two of our major subcontractors that value the lean culture as much as we do. So they can kind of help us lean and assess the other contractors to get on board on this.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Getting everyone on board. We are lucky here because we had two of our major subcontractors that value the lean culture as much as we do. So they can kind of help us lean and assess the other contractors to get on board on this.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
I agree with some of it. I'm learning still. I do agree with the 5S's that's very critical and important. And we not only describe this on the entire project. We are doing that, we are working every week to get better and better. So that's the learning process for us.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
It's complicated. Once you get into this, make your mind to put the effort, to learn as you can. And implement it. Once you do that it becomes easy. The more you practice, the easier becomes.
19. Typically, do you think subcontractors really buy into the LPS?
Not all. It's sad to say but even when some of them see the positive results that come out of this, they still don't want to get on board. That's the battlefield.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Just keep doing it, keep practicing it. Every day on the job. They see it. They know we are doing it and hopefully, they come to terms and start participating, at a hundred percent.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

Yes, oh yes, many times.

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
There is an old say "The squeaky wheel gets the grease", I squeak a lot. Preplanning, a lot of, monitoring progress production, you start seeing that slippage, so you need to start reminding them right away before it comes to a bigger problem. That's a big problem, especially with the smaller subcontractors that don't have the workforce to handle situations like that. To me, the key is communication, if their superintendent comes ahead of time that they have an issue ahead of time, and they need to pull part of their crew of whatever, then we can plan on that. What hurt us is when they don't tell us, and then one day they go from 15 to 4 on their crew. That's when its and issue. That's when it really messes all. Communication is the key if you have something like that, let us know, so we can work together, maybe we can plan to work around that. Sometimes they don't understand that.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
It would definitely improve it, and some way to prevent, but it goes back to participation. If they are a hundred percent involved, then it prevents it. If something happens, then they have the tools or mechanisms to play around that. Is not as bad as the communication, duration, information, manpower, crew size, whatever activities they are performing. If they are just doing it just to say want we want to hear, that's when not.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
The way is set up now is fine, but we need to, it goes back to getting them to participate.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Not on this project.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
The example I gave you that we recovered a delay in a short amount of time was amazing. The way we set up this job, from the very beginning before any work was done we laid the foundation for this. And the whole team is committed. That to me is the most benefit is getting the commitment from the whole team, laying the foundation, setting the grounds and then following it. And then continuous improvement.
27. Do you think the LPS was, or is, effectively carried out on this project?
Yes, most definitely. Are we perfect? No, not by any means. It's the way we do the job. That's it period.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
The onboarding system. I wish we could have done that sooner. Our onboarding system that we do now is amazing. When we first start at the job, we weren't really doing that. And I think if we would have done that, we would have had a better start than what we had.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
That's easy. Number one we probably would not have made up that time that we lost. Also, the subs would get into the change order mode. Where you got the GC screaming to them telling what to do. And then fighting back. You need to pay me. Looking for excuses.

Interview #69

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
First project with the full system.
11. What is your understanding of LC culture and practices?
It's a good way to stay organized, to plan, to eliminate waste that could be created by not planning. To keep everybody together, it helps everybody on the whole project.
12. What are some of the benefits of implementing LC in projects?
Everybody works as a team, they are not fighting, there is no conflict. Where everybody works as a team in the daily huddles, everybody feels they need to put their input there, put all on the boards. So their work could be covered up until its finished.
13. What are some of the challenges of implementing LC in projects?
Making sure everybody is there every day, some new contractors who have never done it, they don't want to be part of it, until they start seen the benefits that we see, they can make coordinate with everybody. They start to be more liable to show up.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
The issues are that there are so many different ways to do it, so it's kind of a broad spectrum plan, you can specify it roam by roam, or treat the project in a whole, and you know, it was hard for me that line, of the specifics, how specific to plan that area, what would be easy for everybody else to understand everything.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
We do our pull planning, they start at the beginning, making it to the end and then we kind of go from the end and work backwards to see if that works better at any time, so it's kind of a last planner system.
16. In your experience, what are the main benefits of using the LPS?
Absolutely.
17. In your opinion, what are the main challenges of implementing the LPS?
It would just be the beginning of it, getting people to cooperate, having people input on it. you can kind of tell the long range of workers that don't want to do it, it seems they the ones typically considerable behind until they realize o maybe this does help and include themselves and brings everybody on the full board team.
18. In your experience, do you think the LPS is complicated?
I think anybody can pick it up if they have the will. It was a lot harder for me without lean, than with lean. I would try to manage it and give dates and say this is how you have to get it done, and I need it done by this date. Here you incorporate them and allow them to tell you how long it can take, and manpower. And if they can't hold their commitments, it's just a phone call to their office.
19. Typically, do you think subcontractors really buy into the LPS?
Yes and no. I think we got that mixed culture into the job. Some do it because they have to.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
For us, it seems motivationally reward. I try to bring donuts for every weekly meeting we have or something different. Making fun for them. Don't make it be there for them, you will want them to want to be there.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?

Yes in the past.

22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
They got to compensate it somehow. Once you are behind you got to pull more effort, so more manpower or longer hours. Or maybe planning to find a way around.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
In the 3 weeks look ahead, we designate the trades here, how many people they are going to have, and people. If those people are here and they start struggling is a phone call to their office. Only planning can prevent this issue to happen. We got the 6 weeks look ahead that we can visualize. We use it in conjunction with each other. All the activities, how many men. If they start falling behind.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
I remember a coworker, he had a good idea, he mentioned manpower during pull planning. But I think there are so many unexpected issues on the jobsite that could potentially be hazards or near hazards. I think that is nearly impossible to prevent it 100% percent, but there are some measures that reduce it. the idea is requiring man-hours in pull planning. Including activity days and man-hours.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Yes, we had to re-engineer all the work several times. Kind of unforeseen and unplanned, that we came up to.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Has benefited the project in such a way that everything here is so regulated and time constricted that every time we need deliveries we have to schedule them with subcontractors. Managed the performance. Not just a contractor, but the jobsite as a whole. Measure and meter it. See if we can make adjustments.
27. Do you think the LPS was, or is, effectively carried out on this project?
Yes, overall yes.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I don't if I can answer that effectively. For us is been doing overwhelmingly well I the project and I'm just happy with the results that we have been able to produce. At this point, I wouldn't consider a change.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Unscheduled deliveries upset owners because of that. Not being able to maintain delivery dates. Not knowing when people are showing up. How many people they got. Maybe they are not doing it a 100% of the contractor work and letting some stuff slide. The process as in procedures that we haven't used. Keep track where they are, we are on top. Whatever needs to be insulated, you know. Sometimes it gets a little overwhelming when you don't have it in their face, you constantly write it down on sticky notes, and eventually stuff gets lost. But this way we got it on the board, we got it on our faces. We can take a picture of it and use it as a reference to solve problems on the field. And you got a picture of any commitment as a reference.

Interview #70

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
5 projects in total.
11. What is your understanding of LC culture and practices?
It's a tool to track progress and schedule at the job and identify problems as they come up, so they can be addressed. That's kind of why we are using it.
12. What are some of the benefits of implementing LC in projects?
It keeps all the information visible, it helps with the daily huddles and the subs, talking to each other, planning the day, it identifies what the group, what the constraints are, so the responsible party can start working on it. The details of the constraints. And then keeping up with the schedule on the 6 weeks schedules.
13. What are some of the challenges of implementing LC in projects?
It's just getting the subs used to use it, and getting them to give us accurate information when we are doing our pool sessions, not have the date we just want to hear, so they can give us accurate information that we can actually use to plan, and also keep the other trades involved in when the other activities are going to start.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
In small projects, it's difficult to keep track of it, as existing conditions on the job, forces kind to adjust our schedules based on problems that we find on the field, but still, we try to hold milestones.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
We are using all of the system, pull plan, schedules, 3-week schedules, scoring them, weekly progress. When we first started without using the tools, we used the huddles, then 2 years ago we started to implement the system. We had a little bit at the time, now we are trying to get all of us to get used to this.
16. In your experience, what are the main benefits of using the LPS?
It buys me a little more time to concentrate on what I have to do, that's one of the benefits.
17. In your opinion, what are the main challenges of implementing the LPS?
Making time to figure it out how to reach the day with the additional work that is required to keep up to it. So when everybody is talking together when they should it does create more time, because subs talking to each other instead of just sending messages, working together.
18. In your experience, do you think the LPS is complicated?
On the smaller jobs, you have a lot of foremen, so it is harder for them because they are not used to it. On bigger projects you have a lot of foreman and superintendents, that are basically keeping the job plan, those guys pick up faster. So the smaller jobs are more challenging.
19. Typically, do you think subcontractors really buy into the LPS?
Yeah, I think they try, I think part of it on smaller jobs, plumber may not be here for 3 or 4 days because they have other stuff to do or they have a big job, on which they have to be there the whole day. You got a lot to do.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
It thinks we've changed a few things with the old system as it is, from what I can tell, as we continue to use it, I'm sure we will change, but right now, I don't see anything. We are constantly getting input from all superintendents.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Daily.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
We track how they keep up with their manpower, with the projected. If it starts slipping and getting behind, typically we refer back to our PM to help us, and they will get with their PM because they usually are in their offices somewhere else.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think right now we get a pretty good response to identifying that kind of issue. The key is trying to figure out as fast that issue with the daily huddles, so we track what they are doing. Enough men, otherwise make a call to their office. No, I don't think the system prevents it. I think If they see the words and keys stay out of work and with the constraint management, they don't have to send people off, that's what they give as an excuse.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
I don't know, the marketplace is saturated with work that a lot of these companies stretch and relax as far as workload, so we ask for more people from the sheetrock and they couldn't do it, so they worked overtime. They know they can't send anybody here. We get that effort from them so that's kind of a tradeoff, it's not a just not, it's an option. To help them stay on track. I think our people when they do the bid out process they can confirm that everybody knows the schedule. Before they bid the job out. And the give me a contractor than can't make the job without the proper manpower. So hopefully they are making note of that, so on the next job they bid, they would put a high profile mark to keep it in mind.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
n/a
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I think the subs have been receptive to it, from what it originally started out being and what we are doing now. I think they see the benefit of it and take the painter. They got guys out there that are trying to work on flow pattern that we talked about and trying to stay on schedule. So I think you just need to tell the ones that are really buying into. I think if you ask a sub about what's the difference between, the way it started, I think they will say they like it better.
27. Do you think the LPS was, or is, effectively carried out on this project?
n/a
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I just think that as a whole our company that is using this system, some time ago we didn't use it for the whole company, now we are using it on the 70%. We started late on this project. The idea is the system as a whole works better if implemented from the very project beginning.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I think we would be a couple of weeks behind. We tried to implement a scoreboard system, where we track it. That's when you can see if from the original pull you really gained time. it's a scoreboard. It is now obvious to us but it's obvious to the owner.

Interview #71

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
3 proyectos en total.
11. What is your understanding of LC culture and practices?
De estar al frente de lo que vas a hacer. De tener una idea de lo que vas a tener haciendo por 2 o 3 semanas. Lo que va a suceder y a las 6 semanas tengamos que hacer durante ese Proyecto.
12. What are some of the benefits of implementing LC in projects?
Que ya sabes por donde vas a ir y dónde vas a toparte con otros trade, ya sabes que ellos van a estar ahí. Son cosas que prepares con tiempo para saber que no vas a tener un retraso con alguien más.
13. What are some of the challenges of implementing LC in projects?
No veo.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
n/a

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Me ha tocado con partes del LPS.
16. In your experience, what are the main benefits of using the LPS?
Si hay beneficios, porque como quiera te ayuda a pensar más enfrente. Te ayuda a la compañía constructora que es lo que quieren llegar primero, de las varias que ellos tienen terminado más pronto.
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No es complicado, a lo mejor no está uno acostumbrado.
19. Typically, do you think subcontractors really buy into the LPS?
Si.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
No se me ocurre nada.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Si, muchas veces. Especialmente ahorita porque hay mucho trabajo. Y a veces hemos tenido que cancelar trabajos. No hay suficientes ayudantes.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Simplemente re agendamos la actividad.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
El Sistema no creo que lo prevenga.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
Pues para mejorarlo es difícil, son cosas de que son trabajos de nosotros de la compañía, pero ya si se van para otro lado, entonces si ya nos perjudica a toda la compañía, pero en realidad si tenemos

más trabajos, con prioridades, pues yo re agendo. No me perjudica. Pero para prevenir eso pues solamente hablando con la compañía, pues consigan más gente.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
Si lo ha beneficiado. Porque estamos planeando ahead todo.
27. Do you think the LPS was, or is, effectively carried out on this project?
Pues todo el tiempo hay cosas que a lo mejor no funcionan.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
Estuvo un poquito al principio no hubo mucha comunicación en muchas compañías y todo. Yo digo al principio. Tenemos que estar más. Hubiéramos estado más ubicado si todo se hubiera planeado bien, pues la otra compañía se hubiera venido a los meetings, cuando tenían que haber venido y no posponerlo. Nos atrasó un poquito en cosas de que nosotros planeamos más Adelante sin ellos. Pero nosotros teníamos que seguir. Entonces muchas veces les digo que nomás tenemos que cerciorarnos de que todo va a estar planeado bien desde un principio con las otras compañías. Para no estar en conflicto después.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
El trabajo tiene que salir de un modo u otro. Hay un schedule que tenemos que cumplir. Pero como quiera hubiera sido más problemático. Un poco más de estrés. Y en realidad casi todo el tiempo no tenemos en todas las compañías y todos los trabajos tenemos un meeting una vez a la semana, y aquí tenemos eso todos los días, para planear y planear y estar. A lo mejor hubiera sido un poco más estresante. Si ayuda.

Interview #72

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
Yes, this is my third project.
11. What is your understanding of LC culture and practices?
It started in the ninety's when a couple of guys tried to implement the ideas of the manufacturing industry to the construction industry to improve the reliability of the team and reduce all types of waste created in the field and office and processes.
12. What are some of the benefits of implementing LC in projects?
There is a lot of communication, and relationships. You see jobsites more organized. Making sure that materials are delivered on time, so we don't need to move them within the site. Communication between team members. Everything is clear. Everybody is on the same page.
13. What are some of the challenges of implementing LC in projects?
There is a lot of challenges mainly in the understanding of the pull process from certain people in the industry. There is much more challenge with the electricians and the plumbers. I think the biggest challenge is for people to understand what's the big idea behind lean. For people to plan ahead of time which is good but a lot of people don't do that. You know people need to understand why we do every tool, boards with stickys, etc.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?

People to understand the idea behind every lean tool. Training.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
It is composed of multiple things. You have different sections. The WWP, the 6 WLP, the constraints log, make ready plan. If all work is together, then you start having things separately, then you get a lot of questions of why we are doing this. When you start using the boards, you should explain why you are using each tool. With the system you have to review all sections, to understand the project picture. If we don't have the entire LPS implemented, you won't be able to get the attention from every single person involved.
16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
And one of the problems is the consultants suggest you need to this and that, but my opinion is that everything should be introduced the whole system, not little pieces because you can question, why do we have week number 7? What's the whole purpose of getting there?
18. In your experience, do you think the LPS is complicated?
I don't think it's complicated as long as it's well defined at the beginning. I think one of the important parts was that you have to do introductions to the new trades on board or new staff to the LPS. if you keep them informed and trained they will perform well.
19. Typically, do you think subcontractors really buy into the LPS?
Not necessarily, as that would be very personal. I think those three points are very important. So every single individual that is participating gets involved in the LPS.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Explain the reasons behind.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yes. Sometimes we get notices from our partners saying watch out with this subcontractor. They may have a lot of work or issues. Finishing trades is a good example, roofing, painting, etc.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
It's hard, you have to accommodate to their manpower and push push push.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
Yes. Not necessarily prevent from that to happen, but what it will prevent would be that they would be more cautious on what they promise to the GC. Having the subcontractor putting the board themselves in the lean sessions, that makes them accountable. It helps. We can't prevent the subcontractor taking every single manpower from the project. It prevents that other trades know what other guys are doing, so they can accommodate their manpower. After using the lean boards, you notice that at the beginning of the project they put the milestones and they were accomplishing the work ahead of the schedule, giving them a couple extra days to accomplish their work. After some time using it, now they are consistent. What the LPS helps is the trades they all can schedule the work accordingly to when big milestones are coming.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

Commitment from your subs should help. Also, a way to send out the plan. If we move from computer schedule to something visual like the boards and paper. Now everything is digital, how do we make the field guys keep track of what they put in the board.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?

Yes. We have noticed that with intercompany projects. In our boards, you can see the effects of others projects in our lean boards. There is not much you can do if they don't have the manpower. It gives you insights for the future, but there is little you can do in that actual week. So it gives you the ability for the future. If there are any critical errors on the low area you can pay attention.

26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?

Benefited. But it's kind of a learning curve. It took us 6 months to take the entire staff team to get them to the boards. You have to put effort into understanding what it is. There is a benefit as long as people know how to use it efficiently.

27. Do you think the LPS was, or is, effectively carried out on this project?

Yes, I think we have been getting a lot of help from our consultants. Because not all of us have been on lean projects. So here we have the WWP, constrain boards, lean boards.

28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?

More buy-in from the superintendents. So, I'll probably would think about a different way to selling it to them. Kind of trying making a different plan. How to make them involved. Accountable for the majority of the system.

29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?

Relationships would not be good. Because you have a project that has been based on the schedule. You will have a lot of conflict between trades. This will probably affect everybody in the team.

Interview #73

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?

I have. We implemented lean probably about 9 to 10 years ago. And I would say the last 5 or 6 projects we used pull planning. Along with the other items that go along the schedule in those practices.

11. What is your understanding of LC culture and practices?

It's about efficiency with the trades. Identify the roadblocks. That's why I believe that pulling the flow out of the schedule get it as efficient as possible. That's the goal.

12. What are some of the benefits of implementing LC in projects?

To have an efficient and productive job in the shorter time as possible. It's a collaborative effort within the subs. As long as we got a buy from the subcontractors. The other trades should understand how it works. It's making the project efficient, reduces waste. Less rework. Collaboration and buy in from the subs. Is more of a team atmosphere.

13. What are some of the challenges of implementing LC in projects?

If it's set up and don't follow the program. If you don't do the daily huddles or the PPC, so it's ineffective. But when do implement that, is the same thing, if the subs are not giving us what we need. We are not getting the buy-in from the subs. The majority of the subs like it once they do it. Helps to make a smoother job. The staff need to buy-in as well.

14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
Most GCs or CMs don't use it, or a lot don't use it, more and more the subs are becoming to it. In the beginning, it was hard because it was something new. If they have done it before it's a lot easier for us.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?
Everything we have been talking about.
16. In your experience, what are the main benefits of using the LPS?
I think we have found if you don't use the complete system is not nearly as beneficial. You have to use the complete system.
17. In your opinion, what are the main challenges of implementing the LPS?
You need to do the pull planning, daily huddles, weekly work plans, and the understand the PPC. To realize why.
18. In your experience, do you think the LPS is complicated?
No. I don't feel it. You have to get used to it. I don't think so. The weekly work plan and daily huddles are simple discussions for the week or day. The PPC is a calculation and really easy to figure it out. Because it's never 100%. If you get the 100% you never get through it.
19. Typically, do you think subcontractors really buy into the LPS?
I think most of them do after they use it for a while. Like anything new. The more sophisticated subs that have used it they already have the buy-in. The less sophisticated have a hard time.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
Education. We bring them and train them. For them to be bought in after some time. Sometimes it takes a full project. As long as is implemented properly.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Not excessively, but it has happened. It depends, on the subs, you need to be very selective. You have to make sure they understand the expectations of the project. Smaller projects suffer more. We betted the subs and laid down the expectations were placed up front. So when we implemented the pull planning, they already know.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
Prequalify subcontractors. When we do the pre-award meeting, we discuss the production rates they need to achieve. If we don't see their manpower we discuss that with them. If that happens we pull the sub and bring it to the attention. Worst case scenario is we bring another sub. That rarely happens.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
I think the lean practices allow a sub to plan their work properly and if they decide to make that decision it identifies it quickly. So if you think about the pull planning sessions, there are a lot of negotiations. The buy-in is the strategy with the schedule of all the subs. When you look at the PPC. If that is not there that identify the issue, and it was because their manpower was pulled out of the job, it identifies quickly to act.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?

You can't prevent it, all you can do is manage it. They will do what they feel is important. I think is part of our job for them to understand this, so they take something they can't take. That's why we prequalify the subs, so we can make sure they will be ok. The only thing you can do is rectify it, but not stop it.

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
No
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I think they have affected it in a positive way. With all the previous items, just the fact of collaboration. They understand the schedule. How to plan their manpower and material deliveries. And the flushing out any issues out there.
27. Do you think the LPS was, or is, effectively carried out on this project?
There is always room for improvement. Maybe we missed some weekly work plans, maybe some subs didn't show up. Maybe the PPC losing calculating all the time. As long as you don't lose the majority of it. There is always area for improvement. And the better we can get out of it, the more subs understand the benefits to them. It comes down to education and experience.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
We have a pretty good system. So I can't think of anything I would change.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
Less collaboration among the subs, more conflicts on the field, less organization on the field, and mis-sequencing. An overall longer schedule. I think the harmony amongst the subcontractor would be affected because they see each other every single day and getting to know each other. Less efficient project. we wouldn't know the reasons why the subs didn't meet the goals.

Interview #74

Basic conception of Lean Construction

Objective: Clarify the previous subject's knowledge and experience about Lean Construction (LC).

10. Have you participated in LC projects in the past? What projects?
This is my first project.
11. What is your understanding of LC culture and practices?
To be able to control on the daily basis the progress and challenges for each subcontractor. To get those results daily, rather than letting some time to pass before realize there is a problem. To me, it brings out the different things of the project that may have a problem daily.
12. What are some of the benefits of implementing LC in projects?
Brings responsibility, accountability for each subcontractor. To meet their goal that they specified.
13. What are some of the challenges of implementing LC in projects?
It's just that it is a new program. To get some of the subs in the field to participate in the program or to buy into it, getting them to buy into this program will also increase their productivity.
14. Did you experience any specific issues that you may note with the initial implementation phase of LC in projects?
I guess it goes back to selling the program to the subcontractors, I think that's the initial challenge.

The Last Planner System

Objective: Clarify the previous subject's knowledge and experience about the Last Planner System (LPS).

15. In your own words, what is your understanding of the LPS?

From what I understand this program, we implement it all. We are combining to a program that can use.

16. In your experience, what are the main benefits of using the LPS?
n/a
17. In your opinion, what are the main challenges of implementing the LPS?
n/a
18. In your experience, do you think the LPS is complicated?
No, I don't. I think it's actually very simple. I think that anything new is the same. I don't have a problem with it, I'm ok. So it's a matter to change the mentality. Anything new that you add to their daily schedule, that is not hard.
19. Typically, do you think subcontractors really buy into the LPS?
I think it's about, here is what I think. It's a matter of introducing. Of getting them more familiar with. On every project, it will go to the next one. And then it will be more involved. I think the culture change will increase. The scheduling will go a lot smoothly. Then that's when they buy in. I don't think they buy into the first project. I think after 2 or 3 projects they will buy in. after that point then that's what it will work for us.
20. What improvements, do you suggest, can be implemented to the LPS to facilitate the buy into this system from the subcontractors?
I think if there is some way to keep that productivity and, every business is a business within the project. so I think if there is some way to show some profit margin by using the system, maybe they use fewer hours, maybe they have overtime. I think bottom line numbers will be the telling factor on this. I think that's how they will buy it.

Understanding the Autonomous Agent

Objective: To evaluate if the Autonomous Agent (AA) is a potential issue for the project.

21. Have you experienced project situations in which the subcontractors underperform, due to external issues (events that happen in other projects where manpower has to be shifted to a subcontractor accommodate emergency) they have in external projects?
Yeah, I think where we experience it out the most is out of town projects. The reason is we are located in this city, so 85% of our work is in this city. So the subs performing here they are onboard with us because they want to get more business in the future with us. Vs out of town they feel is just like one job, you probably won't see me again. So it's easier for them to underperform. That's a challenge. Also, getting on board with lean. It's just really hard to sell.
22. When experiencing underperformance of subcontractors due to external issues they have in external projects, how do you typically handle the situation?
We handle everything diplomatically. We send emails or phone calls. With the immediate people on the job. If that doesn't work, we the step into the company to whatever we need to get there. Then it comes to a point that we need to come and finish the work.
23. In your opinion, is there any tool in the LC practices or the LPS that specifically prevents the possible situation of underperformance of subcontractors, due to external issues they have in external projects?
We had these guys representing the subs and they write their commitments. We take pictures of these boards, weekly, to send them out to the subs. The problem is promises are not kept. Ok, this is the situation, here is what happening to the other subs, it's costing you more money, by not getting this done, you know we got to keep going on this project. So I think in that respect that helps in having them more accountable. As far as anything that we can change. I don't think it's preventable. Because every job is unique. Same with the subs, no two subs are alike. As far as preventing them, no, I think this system here can hold them a little more accountable to us, vs the person.
24. How would you propose to adapt LC practices or the LPS, in order to try to address that issue?
n/a

Project specifics

Objective: To understand the performance of LC, the LPS and the AA on this project.

25. Have you experienced on this project any underperformance issue with a subcontractor, due to external issues (something happening in other projects that the sub is also working on)? How was this situation handled?
Not on this project.
26. Do you think the LC practices and the LPS have affected or benefited this particular project you are working on?
I think it has benefited this project. I think that each sub understands the project and what's going on with the other trades. They become aware of other trades work. These guys are here on a daily basis, now they are forced to talk. They just don't look at each other. It's more like ok here is joe. You know, these like this, more personal. When they go to the field, is more personal. I'm not looking at you as a company foreman, I'm looking at you as a person. I won't be in your way.
27. Do you think the LPS was, or is, effectively carried out on this project?
Again going back to lean construction, with this kind of tools. Even when they grow up this year. the initial roll out came out this year. Trying to get this more personal. So the guys in the roll out process, trying the people in the field. A lot of the beginning was learning as you go. Or try to figure it out for yourself. Now it's consistent from job to job. But initially the roll out was not too good.
28. If you could have changed anything on the implementation phase of the LPS in this project, in order to facilitate this initial process, what would that be?
I think it would have been the having more training for the subcontractors. I think that everybody should know how to implement this program. That would have been a training program.
29. On this project, if no LC practices nor the LPS were implemented at all, this means that only traditional project management techniques were used, what do you think would be the consequences?
I think this particular building, is difficult building. Because of the design and the finishes that are better incorporated. Too many exterior finishes. So you go forward and you have to step back. You can't finish anyone trade and get-off the job and bring them on back so that being said, I think this job, in particular, would be 2 or 3 weeks behind schedule now, than where it is right now.